UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF PREVENTION, PESTICIDES, AND TOXIC SUBSTANCES
WASHINGTON, D.C. 20460

November 13, 2001

MEMORANDUM

SUBJECT: **Sodium Acifluorfen:** Second Revised Occupational and Residential Exposure and Risk Assessment for the Reregistration Eligibility Decision (RED) Document [Case # 819467, PC Code 114402, DP Barcode D279482]

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Attached is the Second Revised Occupational and Residential Exposure and Risk Assessment for the Sodium Acifluorfen HED RED Chapter. The assessment was revised to include new Q_1* for cancer risk, an additional PPE category to match label requirements and new residential applicator exposure data. The assessment reflects current HED policy.

Active EPA Reg #: 4-433, 241-321, 7969-076, 7969-077, 7969-079, 7969-080, 7969-087, 7969-168, 7969-179, 71995-003

EPA MRID #: 423615-01, 440911-01, 440911-02

PHED: Yes, Version 1.1 (August 1998, Surrogate Table)

Expo Sac Reviewers: Alan Nielson and Deborah Smegal, MPH

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1. Occupational and Residential Executive Summary for Sodium Acifluorfen

Summary Description for Sodium Acifluorfen:

Sodium Acifluorfen (Sodium 5-[2-chloro-4-(trifluoromethyl) phenoxy] -2-nitrobenzoate; CAS # 62476-59-9) is the salt of a diphenyl ether and is used as contact herbicide. For the purposes of this assessment this chemical shall be referred to as acifluorfen. According to the Sodium Acifluorfen Use Closure Memo (dated 11/01/99) there are eight registered, supported products of acifluorfen intended for agricultural use and two products for residential use. The agricultural products which are formulated as an emulsifiable concentrate (7 - 21% acifluorfen) are used for post emergence weed control in peanut, rice and soybean fields. The residential product (0.12% acifluorfen) is a ready to use trigger sprayer for spot treatments to kill weeds in driveways, sidewalks, patios and around trees.

Several acifluorfen products also contain other registered herbicides such as: bentazon, sodium salt; glyphosate, isopropylamine salt; and imazaquin, sodium salt. These herbicides are not addressed in this risk assessment. In addition, sodium acifluorfen is a degradate of another registered pesticide, lactofen. Potential exposures from contact with sodium acifluorfen following the application of lactofen products is not addressed in this risk assessment.

As full coverage of a crop is required for acifluorfen to be effective as a contact herbicide, applications to peanuts, rice and soybeans are limited to the use of aerial and groundboom equipment. Spray additives are required for the agricultural products and include non-ionic surfactants, urea ammonium nitrate and crop oil.

Based upon available pesticide survey usage information for the years 1987-1997, the Biological and Economic Effects Division (BEAD) of EPA estimates that total annual domestic usage for applications of acifluorfen is approximately 1.5 million pounds active ingredient (ai) for about 6 million acres treated. Acifluorfen has its largest markets, in terms of total pounds active ingredient, allocated to soybeans (94%), peanuts (4%), and rice (2%). Most of this usage is in Arkansas, Mississippi, Illinois, Missouri, Indiana, North Carolina, Virginia, Texas and Alabama. Crops with a high percentage of the total U.S. planted acres treated include: soybeans (90%), peanuts (3%) and rice (2%).

Sodium Acifluorfen Toxicology Endpoints:

The following endpoints were used in this assessment:

$NOAEL_{Short\text{-}term,dermal}$ and $NOAEL_{Intermediate\text{-}term,dermal}$ = 20 mg/kg/day; dermal absorption = 20%
$NOAEL_{Short\text{-}term,inhalation}$ and $NOAEL_{Intermediate\text{-}term,inhalation}$ = 20 mg/kg/day; inhalation absorption = 100%
$Q_1^* = 1.27 \times 10^{-2}$ $(mg/kg/day)^{-1}$

HIARC and the FQPA SFC determined that MOEs greater than 100 do not exceed the Agency's level of concern for acifluorfen occupational non-cancer exposures. MOEs greater than 1000 do not exceed the Agency's level of concern for acifluorfen residential non-cancer exposures. Occupational cancer risks below 1.0×10^{-4} do not exceed the Agency's level of concern while residential cancer risks do not exceed the Agency's level of concern when they are below 1.0×10^{-6}.

Private Grower and Custom Applicator Non-Cancer and Cancer Risk Assessments:

HED has determined that private growers and custom applicators (i.e. mixers, loaders, applicators, flaggers) are likely to be exposed during acifluorfen use and that these uses would result in short/intermediate term exposures. Because the acifluorfen products are typically applied only one or two times per year, long-term or chronic exposures (i.e., daily exposures which occur for a minimum of several months) are not expected. The anticipated use patterns and current labeling indicate six exposure scenarios based upon the types of equipment that potentially can be used to make acifluorfen applications.

One chemical-specific exposure and biomonitoring study (MRID 423615-01) was submitted by BASF in support of the reregistration of acifluorfen. This study monitored the dermal exposure, inhalation exposure and urinary excretion of private grower owner mixer/loader/applicators who used Blazer for weed control in Wisconsin, New York and Maryland/Delaware. The blazer was applied to soybean fields at a rate of 0.50 lbs ai/acre using groundboom sprayers pulled by open cab tractors. The workers wore single layer PPE without respirators during mixing and baseline PPE during application. Dermal exposure was measured using 10 x 10 cm gauze patches, hand exposure was measured using bag washes, and inhalation exposure was measured in the breathing zone using personal air pumps with air sampling tubes. Biomonitoring was accomplished by measuring acifluorfen residues and metabolites in 24 hour urine samples collected by each test subject for several days before, during and after exposure.

This study was reviewed by the agency and parts of it were found to be acceptable. Most of the analytical dermal data was grade A or B except for the sun exposed dosimeter data which was rated grade C for low recovery. The inhalation data was rated as "low confidence" because the sampling tube did not include a component to capture the aerosol fraction of the herbicide spray. The urine data has severe limitations because the pharmacokinetics of acifluorfen was not well documented, many of the reported results were below the limit of quantification and there were only seven valid test subjects. For the above reasons, only the dermal and inhalation exposure data were used in this assessment. This data indicated that unit exposure values were 5 times higher than those predicted by the Pesticide Handlers Exposure Database (PHED), Version 1.1 (August 1998).

In addition to the submitted study, analyses for both private grower and custom applicator short/intermediate term exposures were performed using PHED. Five mixer/loader, applicator, mixer/loader/applicator and flagger scenarios were evaluated.

The submitted data and calculations indicate that the MOEs for two exposure scenarios (mixing/loading liquids for aerial application and mixing/loading liquids for groundboom application) are below 100 for the baseline level and exceed HED's level of concern. The MOEs for the remainder of the exposure scenarios are above 100 for baseline and higher levels of mitigation and therefore do not exceed HED's level of concern. The data input variables and calculations are included in Appendix B.

The cancer risk calculations for private grower and custom handler/applicator indicate that one exposure scenario (mixing/loading liquids for aerial application) exceeds 1.0×10^{-4} at the baseline level. All of the remaining exposure scenarios at the baseline and higher mitigation levels do not exceed 1.0×10^{-4}. None of the private grower scenarios exceed 1.0×10^{-6} at the label required PPE mitigation level. Approximately half of the custom applicator scenarios exceed 1.0×10^{-6} with label required and single layer PPE while only one scenario exceeds 1.0×10^{-6} with double layer PPE. None of the scenarios exceed 1.0×10^{-6} with engineering controls.

Post-Application Worker Non-Cancer and Cancer Risk Assessments:

The Agency has determined that workers may be exposed to acifluorfen during scouting, hand weeding and irrigating treated areas. Due to the frequency and duration of these exposures coupled with the dissipation of acifluorfen following applications, it was determined that these exposures would be short/intermediate term and would occur primarily by the dermal route. Inhalation exposures are not anticipated for post-application worker exposures, and the Agency currently has no policy/method for evaluating non-dietary ingestion by workers due to poor hygiene practices or smoking. As a result, only dermal exposures were evaluated in the post-application worker assessment. The Agency assumes that all harvesting of peanuts, rice and soybeans will be performed mechanically. In addition, the Agency assumes that transplanting by hand will not occur for these crops in the United States.

A study "Foliar Dislodgeable Residues of Blazer on Soybeans" (MRID 440911-01) was submitted by BASF in support of the reregistration of acifluorfen sodium. This study measured dislodgeable foliar residues (DFR) following groundboom application of Blazer to control weeds in soybean fields in Indiana, Mississippi and Georgia. Two applications, 15 days apart, were made at each site. The amount applied was 0.125 lb ai/acre for the first application and 0.375 lb ai/acre for the second application. Three samples at each site were collected before and after each application then 1, 3, 5, 7, 10, 14, 21, 28 and 35 days after the second application. Leaf disk samples were collected using leaf punches and were dislodged in an ivory soap solution. No acifluorfen sodium residue (LOQ = 0.012 ug/cm^2) was detected prior to either the first or second application at any of the sites. The average acifluorfen sodium DFR on day zero after the second application (n=3) ranged from 0.25 ug/cm^2 in GA to 0.74 ug/cm^2 in MS. Regression analysis of the LN of the DFR levels vs. the days after treatment yielded a half life of 1.4 days for the Indiana data (r = 0.97, n=18), 0.45 days for the Mississippi data (r = 0.99, n=9) and 0.72 days for the Georgia data (r = 0.87, n= 9).

The DFR study was reviewed by the Agency and was found to be acceptable. The DFR data for the Indiana and Mississippi sites were used for the calculations of Post Application exposures and risks. The Georgia data were not used because DAT 0 values were substantially less than the DAT 0 values for Indiana and Mississippi. The post application non-cancer risk calculations indicated that the MOEs greater than 100 on Day 0 which suggests that the current REIs are appropriate. In addition, none of the post-application cancer risks to private grower and professional workers is greater than 1.0×10^{-4} for day 0 exposures at typical acifluorfen application rates. The current REI for acifluorfen is 48 hours based on acute eye irritation.

Residential Applicator Non-Cancer and Cancer Risk Assessments:

HED has determined that residential pesticide applicators are likely to be exposed to acifluorfen during one scenario (spot treat weeds in driveways, sidewalks, patios and around trees). Exposure data (MRID 444598-01) that had been submitted by Aventis in support of the reregistration of carbaryl was used to evaluate this scenario. This study, which included RTU trigger sprayer applications of an insecticide to home vegetable plants, was found to be of high quality and relevant to the acifluorfen exposure scenario. The calculations of residential applicators' non-cancer risks using study data indicated an MOE of 18000 which is greater than the target MOE of 1000 and is therefore not of concern. The target MOE of 1000 includes a 10X FQPA safety factor for females 13-50 years of age. A cancer risk of 4.5×10^{-8} was calculated for this scenario which is less than the target cancer risk of 1.0×10^{-6} and is therefore not of concern. There are no concerns of post application residential exposure because residential uses are limited to spot treatments which do not include broadcast application to lawns. In addition, the label states that acifluorfen kills grass.

Incident Reports:

No incidents involving acifluorfen were found in the data sources consulted by the Health Effects Division.

Information and Data Needs:

Several areas of the risk assessment and characterization would improve with more information and data. Areas of information and data needs include:

- Additional dermal absorption data to refine the dermal absorption factor of 20 percent which was derived from a ten hour rat study done in 1986. This data is needed to determine if the use of a soap solution will significantly decrease the material remaining on the skin and if the material remaining on the skin after washing is available for absorption.

2. Background Information

This revised document is based upon the following referenced documents.

(1) Revised Sodium Salt of Acifluorfen (Tackle™, Blazer™) Quantitative Risk Assessment (Q1*); Author: Lori L. Brunsman, SAB/HED/OPP (11/08/01) [HED TXR No. 0050263] .
(2) Acifluorfen - Report of Food Quality Protection Act Safety Factor Committee ; Author: Brenda Tarplee, (09/29/99) [HED Doc. No. 013764].
(3) Acifluorfen Hazard Identification And Review Committee Report; Author: Paul Chin, PhD, RRB1/HED/OPP; (04/07/99) [HED Doc. No. 013308].
(4) Review of Acifluorfen (Tackle (R)), Dermal Absorption Study, (2/11/86) [EPA Accession #260951]
(5) Acifluorfen: Review of Incident Reports; Authors: Jerome Blondell, PhD, and Monica Spann, MPH, CEB1/HED/OPP; Chapter directed to Kit Farwell, DVM, RRB1/HED/OPP (04/06/00).
(6) Acifluorfen labels.
(7) Acifluorfen Use Closure Memo; Author: Christina Scheltema, CRM for acifluorfen, SRRD/OPP; Memo directed to Acifluorfen Team (11/01/99).
(8) Draft Standard Operating Procedures for Residential Exposure Assessments. U.S. EPA. February 10, 1998.
(9) HED Science Advisory Council for Exposure, Policy 003.1, "Agricultural Default Transfer Coefficients" Health Effect Division, Office of Pesticide Programs. August, 1998.
(10) HED Science Advisory Council for Exposure, Policy.007, "Use of Values from the PHED Surrogate Table and Chemical-Specific Data." Health Effects Division, Office of Pesticide Programs. January, 1999.
(11) HED Science Advisory Council for Exposure, Policy.009, "Standard Values for Daily Acres Treated in Agriculture" Health Effects Division, Office of Pesticide Programs. July 2000.
(12) PHED Surrogate Exposure Guide, V1.1. Health Effects Division, Office of Pesticide Program. August, 1998."
(13) A Strategy for Assessing and Managing Occupational Exposures, 2nd edition, AIHA Press, 1998.

3. Occupational and Residential Exposure and Risk Characterization

Occupational and residential exposure and risk assessments are required for an active ingredient if: (1) certain toxicological criteria are triggered **and** (2) there is potential exposure to handlers (i.e., mixers, loaders, applicators, etc.) during use or to persons entering treated areas after application is completed. Sodium Acifluorfen (Sodium 5-[2-chloro-4-(trifluoromethyl) phenoxy] -2-nitrobenzoate; CAS # 62476-59-9) meets both criteria. Sodium Acifluorfen (referred to as Acifluorfen hereafter) is a diphenyl ether in acute toxicity categories II and III by the oral and dermal routes and acute toxicity category IV by the inhalation route. There is potential exposure to private grower and custom pesticide applicators from agricultural site

applications of acifluorfen. In addition, the general public may be exposed to acifluorfen when applying it in the residential environment.

Several of the acifluorfen products for agricultural use also contain other registered active ingredient herbicides such as bentazon, sodium salt; glyphosate, isopropylamine salt; and imazaquin, sodium salt. These ingredients are not addressed in this risk assessment. In addition, sodium acifluorfen is a degradate of another registered pesticide, lactofen. Potential occupational exposures from contact with sodium acifluorfen following the degradation of applied lactofen was addressed in the risk assessment for lactofen. Currently, lactofen is only formulated for agricultural uses and is not used in a residential setting.

3.a. Summary of Acifluorfen Use Patterns and Formulations

3.a.i. Acifluorfen Uses

Based upon the Sodium Acifluorfen Use Closure Memo (dated 11/01/99) which can be found in Appendix A of this document, there are registered, supported products of acifluorfen intended for both occupational and residential site applications. The registered agricultural uses include peanuts, rice and soybeans. Residential homeowners may use acifluorfen products as a ready to use trigger sprayer for the spot treatment of weeds. Other types of residential applications/uses are not permitted without additional review.

Based upon available pesticide survey usage information for the years 1987-1997, the Biological and Economic Effects Division (BEAD) of EPA estimates that total annual domestic usage for applications of acifluorfen is approximately 1.5 million pounds active ingredient (ai) for about 6 million acres treated. Acifluorfen has its largest markets, in terms of total pounds active ingredient, allocated to soybeans (94%), peanuts (4%), and rice (2%). Most of this usage is in Arkansas, Mississippi, Illinois, Missouri, Indiana, North Carolina, Virginia, Texas and Alabama. Crops with a high percentage of the total U.S. planted acres treated include: soybeans (90%), peanuts (3%) and rice (2%).

3.a.ii. Mode of Action and Targets Controlled

Acifluorfen is used for selective postemergence control of certain broadleaf weeds and grasses. It is a contact herbicide, therefore, weeds must be thoroughly covered with spray.

3.a.iii. Formulation Types and Percent Active Ingredient

According to EPA OPP REFS label tracking system, there are currently 9 active products of acifluorfen manufactured. A total of 46 active and non-active acifluorfen products are produced by 10 companies for 14 different types of use sites to control 222 pest species. Acifluorfen is formulated for agricultural uses as an emulsifiable liquid concentrate which contains 6.8 to 21.4% active ingredient (ai), and for residential uses as a liquid ready-to-use (RTU) trigger sprayer

product which contains 0.12% ai.

3.a.iv. Maximum Application Rates, Timing and Frequency of Applications

The Sodium Acifluorfen Use Closure Memo specifies the maximum and typical (or average) acifluorfen application rates for agricultural uses. These rates are given in Table 1. Typically one or two applications are made early in the growing season to kill weeds less than 4 inches tall. In the case of Blazer, for example, applications of 0.125 lbs ai/acre and 0.375 lbs ai/acre are made 15 days apart to reach the maximum seasonal application rate of 0.5 lbs ai/acre/season.

Two residential use products: (1) Ortho Kleeraway Grass and Weed Killer and (2) Kleenup Grass and Weed Killer are listed in the REFS system. These products are packaged in 24 ounce to 1 gallon containers with built in trigger sprayers and are intended for spot treatment of weeds on driveways, sidewalks, patios and around trees. More recent information obtained from www.ortho.com indicates that Kleeraway Grass and Weed Killer currently does not contain acifluorfen. Residential use product information is given in Table 2.

Table 1 - Application Rates for Acifluorfen Agricultural Products

Product	Crop	Maximum Application Rate Per Application (lbs ai/Acre)	Typical Rate per Acre per Season(lbs ai)	Maximum Rate per Acre per Season(lbs ai)
Blazer	Peanuts	0.375	0.250	0.500
Storm	Peanuts	0.250	0.250	0.500
Blazer	Rice	0.250	0.125	0.250
Storm	Rice	0.250	0.250	0.250
Blazer	Soybeans	0.375	0.188	0.500
Status	Soybeans	0.375	0.188	0.500
Storm	Soybeans	0.250	0.250	0.500
Conclude Xtra B	Soybeans	0.250	0.250	0.250
Galaxy	Soybeans	0.250	0.168	0.250
Sceptor OT	Soybeans	0.250	0.250	0.500
Manifest	Soybeans	0.168	0.168	0.168
Conclude Ultra B	Soybeans	0.158	0.158	0.158

Table 2 - Residential Use Product Information for Acifluorfen		
Product/Company	**Use**	**Formulation and Application Method**
Ortho Kleeraway Grass and Weed Killer/ Monsanto	Spot treatment of weeds on driveways, sidewalks, patios and around trees	Ready to use liquid containing 0.12% Acifluorfen. Applied with a built in trigger sprayer
Kleenup Grass and Weed Killer/ Bonide		

3.a.v. Methods and Types of Equipment for Mixing, Loading, and Application

Acifluorfen is applied using aerial and groundboom spray equipment to ensure adequate coverage of the target weeds.

3.b. Occupational and Residential Exposure and Risk Assessments

The Agency has determined that there is potential for exposure in occupational settings from handling acifluorfen products during the application process (i.e., mixer/loader, applicator, and flagger) and from entering previously treated areas. In addition, the Agency has determined that there is potential for residential applicator exposure while applying acifluorfen products in residential environments to kill weeds. As a result, risk assessments have been completed for private grower and custom applicator scenarios, worker post-application scenarios, and residential applicator scenarios.

3.b.i. Endpoints and Calculations Used in the Exposure and Risk Assessments

The toxicological endpoints that were used to complete occupational and residential exposure assessments are summarized in Tables 3 and 4. These endpoints were selected from animal studies by the Health Effects Division Hazard Identification Assessment Review Committee (HEDs HIARC) and are discussed in detail in the HIARC document (HED Document #013308 of 4/7/99). The Food Quality Protection Act (FQPA) safety factor of 10 was retained for short- and intermediate-term dermal and inhalation exposures to most sensitive residential subgroup (females 13-50 years of age). A FQPA safety factor of 3 was assigned for chronic residential exposures to the subgroup of females 13-50 years of age. Please note that intermediate-term and chronic residential exposures are not anticipated.

Table 3. Acute Toxicity Categories for Sodium Acifluorfen.		
Test	**Results**	**Toxicity Category**
Acute Oral Toxicity	LD_{50} = 1540 mg/kg/day (rats) LD_{50} = 186 mg/kg/day (dogs)	III II
Acute Dermal Toxicity	LD_{50} > 2000 mg/kg/day (rabbits)	III
Acute Inhalation Toxicity	LC_{50} > 6.9 mg/L	IV
Acute Eye Irritation	Severe eye irritant	I
Acute Dermal Irritation	Moderate dermal irritant	II
Skin Sensitization	Not a skin sensitizer	----

Table 4. Toxicology Endpoints for Sodium Acifluorfen				
Test	**Study**	**Dose**	**Endpoint**	**UF**
Dermal – Short-Term and Intermediate-Term	Developmental (Rat)	NOAEL = 20 mg/kg/day (Dermal absorption rate = 20% of oral absorption)	Decreased fetal weight and increased incidences of dilated lateral ventricles of the brain	100 for occupational and 1000 for residential exposures
Inhalation -- Short-Term and Intermediate-Term	Developmental (Rat)	NOAEL = 20 mg/kg/day (Inhalation absorption rate =100% of oral absorption)	Decreased fetal weight and increased incidences of dilated lateral ventricles of the brain	100 for occupational and 1000 for residential exposures
Cancer (dermal and inhalation)	Cancer (mice)	$Q_1^* = 1.27 \times 10^{-2}$ (mg/kg/day)$^{-1}$	Liver tumors (adenomas, carcinomas, and adenomas /carcinomas combined) and stomach tumors (papillomas) in both sexes of mice	

NOAEL = No Observable Adverse Effect Level and UF = Uncertainty Factor

Exposure and Risk Equations for Occupational and Residential Handlers

Daily dermal and inhalation exposures, daily doses, and risks are calculated as described below. These calculations are used for private grower, custom applicator and residential pesticide handlers and applicators. The first step is to calculate daily dermal and inhalation exposures.

Daily dermal exposure is calculated:

Daily dermal exposure = Unit exposure x Application rate x Area Treated
(mg/day) (mg/lb ai) (lb ai/acre) (acres/day)

Where:

Daily dermal exposure = amount deposited on the surface of the skin that is available for dermal absorption, also referred to as potential dose (mg/day);
Unit exposure = normalized exposure value (mg exposure per pound ai handled) derived from chemical specific study data or from the PHED Surrogate Exposure Table
Application rate = normalized application rate based on a logical unit treatment such as acres, a maximum value is generally used (lb ai/acre); and
Area treated = normalized application area such as acres/day.

[Note: (lb ai/acre) and (A/day) are replaced, respectively, with (lb ai/gal) and (gal/day) when appropriate]

Daily inhalation exposure is calculated:

Daily inhalation exposure = [Unit exposure x Application rate x Area Treated] / Conversion Factor
(mg/day) (ug/lb ai handled) x (lb ai/acre) x (acres/day) (1 mg/1000 ug)

Where:

Daily inhalation exposure = amount available for absorption, also referred to as potential dose (mg/day);
Unit exposure = normalized exposure value (µg/lb ai handled) derived from study data or PHED;
Application rate = same as for dermal exposure (lb ai/acre); and
Daily treatment = same as for dermal exposure (acres/day).

Daily dermal and inhalation doses are then calculated by normalizing the daily dermal and inhalation exposures by body weight. For private grower and custom applicators using acifluorfen, a body weight of 60 kg (adult female body weight) was used for all exposure scenarios because the effects observed in the toxicological studies were of concern for females 13-50 years of age.

Daily inhalation exposure levels were calculated for inclusion into the PHED surrogate exposure tables and presented as (µg/lb ai) based on a human inhalation rate of 29 L/minute and an 8-hour working day. The dermal and inhalation doses for short- and intermediate-term scenarios were calculated using the following equation.

Absorbed Daily Dose is calculated:

Absorbed daily dermal or inhalation dose = (Daily dermal or inhalation exposure x absorption factor) / body weight
(mg/kg/day) (mg/day) (unitless) (kg)

[Note: 60 kg human; calculates a potential biologically-available dose resulting from dermal or inhalation exposure; an absorption factor of 0.20 was used for dermal exposures and 1.0 for inhalation exposures.]

Because exposures from the dermal and inhalation routes have the same toxicological effects, a combined absorbed daily dose can be calculated. Once the combined absorbed daily doses are calculated, the combined Margins of Exposure (MOEs) can be calculated.

Combined Absorbed Daily Dose is calculated:

Combined Dose (mg/kg/day) = Absorbed dermal dose (mg/kg/day) + Absorbed inhalation dose (mg/kg/day)

Combined Margin of Exposure is calculated:

Combined MOE (unitless) = NOAEL (mg/kg/day) / Combined Dose (mg/kg/day)

Combined MOEs greater than 100 for private grower and custom applicator exposures to acifluorfen do not exceed the Agency's level of concern.

The HED Cancer Peer Review Committee determined sodium acifluorfen to be a B2 carcinogen (probable human carcinogen) and calculated a potency value or Q_1* of 1.27×10^{-2} $(mg/kg/day)^{-1}$. Cancer risks of less than 1.0×10^{-4} (one in ten thousand) for the occupational population and less than 1×10^{-6} (one in a million) for the general population do not exceed the Agency's level of concern. The Agency closely examines occupational cancer risks in the 1×10^{-4} to 1×10^{-6} range and seeks ways to reduce occupational cancer risks to the greatest extent feasible, preferably 10^{-6} or less. When this approach is used, the implicit assumptions are that any exposure will lead to some level of risk and that risk is directly and linearly proportional to exposure, regardless of the dosing schedule.

Average daily doses for cancer risk assessments are calculated as described above for non-cancer risk assessment except that the average application rates are used instead or the maximum rates. Once the Average daily dose is calculated, a Lifetime Average Daily Dose (LADD) can be calculated. To obtain the cancer risk associated with a specific exposure scenario, the LADD is multiplied by Q_1*.

Lifetime Average Daily Dose (LADD) is calculated:

LADD = Combined Dose x (# days worked/365 days per year) x (35 years worked/70 year lifetime)
(mg/kg/day) (mg/kg/day)

[Note: the # days worked by custom applicators is typically 10 times that of private growers.]

Cancer Risk is calculated: Cancer Risk = LADD (mg/kg/day) x Q_1^* $(mg/kg/day)^{-1}$

Exposure and Risk Calculations for Post-Application Worker Assessments

The Agency is concerned about potential occupational post-application exposure to acifluorfen from entering treated agricultural fields for scouting, hand weeding and irrigating. The Agency anticipates that all harvesting of peanuts, rice and soybeans will be performed mechanically and will request confirmatory data regarding this assumption. In addition, the Agency assumes that transplanting by hand will not occur for these crops in the United States. The calculations used to estimate daily dermal dose and MOE for the dermal post-application scenarios are similar to those described previously for the private grower and custom applicator scenarios. The only significant differences are: (1) the manner in which daily dermal dose is calculated using a transfer coefficient, transferable residues, and accounting for the dissipation of acifluorfen over time and (2) inhalation exposures were not calculated for the post-application scenarios because inhalation exposures have been shown to account for a negligible percentage of the overall body burden. This is particularly true for Acifluorfen which has a very low vapor pressure (0.01mPA at 20 C).

The following equation was used to calculate dermal doses for acifluorfen on each post-application exposure day after application.

Post-Application Dermal dose is calculated:

Dermal dose = (TR(t) x TC x DA x conversion factor x # hours worked/day) / body weight (kg)
(mg/kg/day) (ug/cm^2)

Where:

Dermal dose (t) = dermal dose attributable to exposure at time (t) when engaged in a specific mechanical activity or job function (mg/kg/day);
Transferable residue (TR) = transferable residue or foliar dislodgeable residue at time (t) [$\mu g/cm^2$];
TC = transfer coefficient or measure of the relationship of exposure to transferable residue concentrations while engaged in a specific mechanical activity or job function;
DA = dermal absorption factor = 0.2
Hours worked/day = exposure duration or hours engaged in specific mechanical activity (hrs/day); and
Body weight = body weight (kg).

[Note: no chemical-specific transfer coefficients were available; standard transfer coefficients are presented later in text;

Once the post-application dermal doses are calculated, the dermal Margins of Exposure (MOEs) can be calculated. Dermal MOEs greater than 100 for post-application worker exposures to acifluorfen do not exceed the Agency's level of concern.

Margin of Exposure is calculated:

MOE (unitless) = NOAEL (mg/kg/day) / Absorbed Dermal Dose (mg/kg/day)

3.b.ii. Risk Assessment Assumptions and Factors

The following assumptions and factors were used in order to complete the exposure and risk assessments contained in this document:

- The average work day was 8 hours.
- The daily acreages treated were taken from EPA Science Advisory Council for Exposure Policy #9 "Standard Values for Daily Acres Treated in Agriculture," Revised July 5, 2000.
- Maximum label application rates were used to evaluate non-cancer occupational risk.
- Average application rates were used to evaluate cancer occupational risk.
- C Private growers were assumed to have two days exposure per year during the handling and application of acifluorfen to single farms.
- C Custom applicators were assumed to have twenty days exposure per year during the handling and application of acifluorfen to multiple farms.
- C Private growers were assumed to have two days of post application exposure per year following acifluorfen applications.
- C Professional Farm Workers were assumed to have twenty days of post application exposure per year following acifluorfen applications.
- C Unit exposure values were calculated in PHED using the following protection factors for PPE: double layer of clothing = 50% PF for dermal exposure to the body, chemically resistant gloves 90% PF for dermal exposure to the hands, dust mask 80% PF for inhalation exposure and half face cartridge respirator = 90% PF for inhalation. Engineering controls are assigned a protection factor of 90% to 98% depending upon the type of engineering controls selected.
- C A body weight of 60 kg was assumed for all non-cancer scenarios because the non-cancer endpoint of concern relates to females 13-50 years of age.
- C A body weight of 70 kg was assumed for all cancer scenarios.
- C For the non-cancer occupational exposure assessments of acifluorfen, a Margin of Exposure (MOE) of 100 was assigned by HIARC.
- C For the residential applicator assessment of acifluorfen, a MOE of 1000 was assigned for the subgroup of females 13-50 years of age by FQPA SFC; a body weight of 60 kg was assumed for females in this subgroup.

3.b.iii. Occupational Handler Exposure Data Sources

Submitted Studies

The following chemical specific occupational handler exposure study was submitted by BASF in support of the reregistration of acifluorfen, and was judged to be appropriate for use in the HED occupational exposure/risk assessments.

***EPA MRID 42361501**: Baughner, D. (1992) **Passive Dermal Dosimetry and Biological Monitoring of Exposure of Mixer/Loaders and Applicators to Blazer (Acifluorfen-Sodium)** Unpublished study prepared by Orius Associates**;**

*Memorandum: Review of Acifluorfen (Blazer) Groundboom Mixer/Loader/Applicator Exposure and Biomonitoring Study: D270365; dated 2/7/01 by Timothy C. Dole

The purpose of this study was to monitor worker exposure and urinary excretion during the groundboom application of acifluorfen - sodium to soybeans to control weeds. This study was submitted by BASF to support the registration of acifluorfen-sodium. The formulation used in this study was Blazer Herbicide, a 2 lb/gallon soluble concentrate formulation of acifluorfen-sodium. Citowett Plus nonionic surfactant was used an adjuvant.

This study was conducted at three farms in Wisconsin, two farms on the Maryland/Delaware peninsula and two farms in New York. Two or three workers were monitored on each farm for a total of 10 workers. The weather conditions were well documented and were typically hot and humid. The worker clothing and PPE usage was well documented and workers generally wore long sleeve shirts with or without short sleeve T-shirts underneath; and long pants or cotton long zip front coveralls. Solvex nitrile gloves, chemical goggles and rubber boots were generally worn during mixing/loading. Gloves were not worn during application except to adjust nozzles and make repairs. The spray mixture was mixed by the workers by manually pouring the Blazer and Citowett Plus additive into the tanks and diluting with water from a hose. It was observed that the additive caused excessive foaming. Blazer was applied at a rate of 0.54 lb. ai/acre with a dilution rate of 17-27 gallons of water per acre. Two to eight tank-loads of finished spray were handled per replicate and an average of 9 acres per hour was treated. The spray was applied by one saddle mounted and nine tractor pulled ground booms. Two of the tractors had semi-enclosed cabs with the back and/or side windows open while the remaining tractors did not have cabs.

Dermal exposure was measured by collecting ten half day and five full day dermal sample sets for a total of 15 replicates. Each sample set consisted of thirteen glassine-backed cotton gauze patches that covered approximately five percent of the workers body. The author stated that "whole body dosimeters were not used: the interception of residues available for dermal absorption would have confounded the biological monitoring." Three of these patches were attached to the outer surface of the workers clothing at the top of the baseball cap, back of the

neck and next to the chest "V." The other ten patches were attached to the worker's skin using surgical tape at the shoulders, mid-forearms, front thighs, shins, back and chest. The patches were removed at the end of the sampling period by cutting the taped corners with scissors. Hand exposure was monitored by handwashing with ivory soap in water. Inhalation monitoring was done in the worker's breathing zone using personal air sampling pumps and octyldecyl silane monitoring tubes.

Biomonitoring was accomplished by measuring acifluorfen residues in total daily urine samples collected by each test subject before, during and after application. Urine volume, specific gravity and creatinine were also measured.

Acifluorfen was quantified in cotton gauze dosimeter pads, detergent wash water, inhalation monitoring tubes and urine using capillary gas chromatography. Acifluorfen Amine Metabolite was quantified in urine using high performance liquid chromatography. The methods were validated by fortifying six replicates of each type of media at four fortification levels which ranged from the LOQ to 5000X LOQ. The average recoveries ranged from 88.1% to 97.6% and the coefficients of variation ranged from 9.7 to 12.6. The recoveries at the lowest level of fortification were similar to the average recoveries. The limits of quantification (LOQ) were 0.1 ug for dosimeter patches and inhalation tubes and 0.1 ug/ml for the 3000 ml handwash and 1200 ml urine samples.

A pilot field fortification test indicated that the average recovery for dosimeters exposed to the sun for <1 hour was 53.2 % and eight hours was 19.5%. The recoveries at the lowest fortification level of 22 ug/2 pads was 0.0%. The average recoveries for the inhalation tubes was 70.2% for 8 hour sun exposure and 75.9% for <1 hour sun exposure because the barrels of the tubes were covered with duct tape. The recoveries at the lowest fortification level of 7.5 ug/tube was similar to the average recoveries. The recoveries for the other media, which were not exposed to the sun, were 86.2% for handwash solution and 90% for urine.

Monitoring media were also fortified in the field and in the lab and were handled in the same manner as samples from the monitored workers with the exception that they had less exposure to the sun (field media was stored in the shade). With the exception of the sun exposed dermal dosimeter pads, the field recoveries were above 60% at all fortification levels. The lab fortification recoveries were above 66% at all fortification levels. Storage stability recovery was above 64% for all media at the longest storage interval of 252 days.

The results were adjusted by the author for the mean recovery of field fortified positive controls. The unit exposure values as shown in Table 5 were calculated by the Agency using the data from this study and Lotus 123. Additional adjustments were made by the Agency to the head and neck dosimeter results to account for low recovery of the sun exposed samples. The overall effect of this adjustment was a dermal unit exposure increase of 20% because the head and neck are only 7% the skin surface area and because only eight out the fifteen replicates had full

sun exposures. The other seven replicates had low sun exposures because of cloud cover or closed cab tractors.

The Shapiro and Wilk Test (W-test) indicated that the dermal and inhalation data have a lognormal distribution while the urinary data have a normal distribution. In keeping with the procedures used for PHED exposure analysis, the geometric mean was used for exposure assessment. Default values from PHED Scenario #28 are included for comparison.

Table 5 - Unit Exposure Calculations

	Dermal Exposure (n=15)	Inhalation Exposure (n=15)	Urinary Excretion/Exposure (n=7)
Units	ug/lb ai		[(ug/kg BW)/(ug/kg BW)] *100
Arith Mean	297	2.74	0.63
Geo Mean	185	1.21	0.45
50th Percentile	200	1.07	0.45
95th Percentile	747	9.51	1.6
PHED DATA*	57	1.3	N/A

* PHED Scenario #28 - Liquid/Open Pour/Groundboom/Open Cab (MLAP), Single layer, gloves

The urine sample for one worker was a statistical outlier on day zero and the authors suspected that the sample was contaminated. The urine samples for another worker also showed significant excretion on days -3 and -1 before the study. One worker had an extremely high dermal exposure because he leaned against the tank during mixing and loading. According to the author, however, this was the worker's normal practice and the samples for this worker were included by the agency in all three of the regression analyses.

The mean percent urinary excretion was 0.63%. The author stated in the study protocol that acifluorfen is excreted in the urine as unchanged parent compound, <1% of the administered dose is retained in the body after oral administration to the rat and dog, and that the major metabolite, which occurs at relatively low concentrations, is the amine derivative of the parent compound. The author also stated that 70% of the systemic dose is excreted in the urine. No references were given for these statements.

The rational for the selection of the inhalation monitoring media was not explained in the study. The media did not have a filter component to capture the aerosol phase of the pesticide spray nor did it include a backup section to measure breakthrough of the vapor phase. Given the low vapor pressure of acifluorfen, it is suspected that airborne acifluorfen would be occur primarily as a mist or aerosol.

After the study, additional testing was done to determine if low recovery of the dermal pads exposed to the sun was due to degradation of acifluorfen by ultraviolet light. It is suspected that the positive control field recoveries reported for dosimeter pads in the study were higher than the sun exposed sample recoveries because the positive controls were covered with a layer of gauze and exposed to partial sun during the replicate while the sample was exposed to full sun. The pilot recovery studies conducted before the study indicated low recoveries of sun exposed dermal pads whereas the bridging studies conducted after the study indicated much higher recoveries. It is suspected that the ultraviolet (UV) intensity during the bridging test conducted in late October was less than the UV intensity during the field tests which were conducted in June and July and the pilot tests which were conducted in May. NOAA UV Index Data for 1998 indicates that the clear sky UV index in Dover, Delaware was 7-9 in May, 8-10 in June/July and 3-4 in October.

The LOD for the urine was listed as 0.01 ug/ml (or 12 ug per typical 1200 ml sample) in the study text but no LODs or LOQs were listed in the individual worker urinary excretion tables. The lowest urinary excretion value in the tables was 0.00016 ug/ml (0.29 ug for the 1080 ml sample) which suggests a limit of detection much less than 0.01 ug/ml. The actual limits of detection could not be determined. This discrepancy affected the unit exposures because many of the urine results reported in the urinary excretion tables were below the LOQs. The LOQ values were substituted by the Agency for the values reported by the author where the values reported by the author were below the LOQ.

Most of the analytical data was the dermal samples was grade A or B except for the sun exposed dosimeter data which was rated grade C for low recovery. An overall PHED grade of ABC/Medium Confidence was assigned to this study. The inhalation data was rated as "low confidence" because the sampling tube did not include a component to capture the aerosol fraction of the herbicide spray. The urine data has severe limitations because the pharmacokinetics of acifluorfen was not well documented, many of the reported results were below the limit of quantification and there were only seven valid test subjects. For the above reasons, only the dermal and inhalation exposure data were used in this assessment.

PHED Exposure Analysis

In addition to the submitted study, analyses for the other exposure scenarios were performed using the Pesticide Handlers Exposure Database (PHED). Five mixer/loader, applicator, mixer/loader/applicator and flagger scenarios were evaluated.

PHED was designed by a task force of representatives from the US EPA, Health Canada, the California Department of Pesticide Regulation, and member companies of the American Crop Protection Association. PHED is a software system consisting of two parts – a database of measured exposure values for workers involved in the handling of pesticides under actual field conditions and a set of computer algorithms used to subset and statistically summarize the selected data. Currently, the database contains values for over 1,700 monitored individuals (i.e., replicates).

Users select criteria to subset the PHED database to reflect the exposure scenario being evaluated. The subsetting algorithms in PHED are based upon the central assumption that the magnitude of handler exposures to pesticides are primarily a function of task (e.g., mixing/loading/applying), formulation type (e.g., wettable powders, granulars), application method (e.g., aerial, groundboom), and levels of personal protective clothing worn by the private grower and custom pesticide applicator (e.g., gloves, double layer of clothing).

Once the data for a given exposure scenario have been selected, the data are normalized (i.e., divided by) by the amount of pesticide handled resulting in standard unit exposures (milligrams of exposure per pound of active ingredient handled). Following normalization, the data are statistically summarized. The distribution of exposure values for each body part (e.g., chest, upper arm) is categorized as normal, lognormal, or "other" (i.e., neither normal nor lognormal).

A central tendency value is then selected from the distribution of the exposure values for each body part. These values are the arithmetic mean for normal distributions, the geometric mean for lognormal distributions, and the median for all "other" distributions. Once selected, the central tendency values for each body part are composited into a "best fit" exposure value representing the entire body.

The unit exposure values calculated by PHED generally range from the geometric mean to the median of the selected data set. To add consistency and quality control to the values produced from this system, the PHED Task Force has evaluated all data within the system and has developed a set of grading criteria to characterize the quality of the original study data. The assessment of data quality is based upon the number of observations and the available quality control data. These evaluation criteria and the caveats specific to each exposure scenario are summarized in Table B1 of Appendix B. While data from PHED provide the best available information on handler exposures, it should be noted that some aspects of the included studies (e.g., duration, acres treated, pounds of active ingredient handled) may not accurately represent labeled uses in all cases. HED has developed a series of tables of standard unit exposures for many occupational scenarios that can be used to ensure consistency in exposure assessments.

3.b.iv. Mitigation Summary

Two common risk mitigation approaches used by the Agency are personal protective equipment (PPE) such as chemically-resistant gloves or a double layer of clothing and the use of engineering controls such as closed tractor cabs and closed mixing and loading systems. A tiered approach is used beginning with the baseline mitigation level and, if required, increasing the levels of PPE and engineering controls to achieve an acceptable margin of exposure or cancer risk. Administrative controls are generally not considered as mitigation, because exposure assessments are conducted with respect to the current registered labels. A listing of the mitigation levels is given in Table 6.

Table 6 - Mitigation Levels Using PPE and Engineering Controls.			
Mitigation Level	Clothing	Gloves	Respirator
Baseline	Long Sleeve shirt and long pants	None	None
Label Required PPE	Long Sleeve shirt and long pants, Chemical Goggles, Hat	Chemical Resistant	None
Single Layer PPE	Long Sleeve shirt and long pants, Chemical Goggles, Hat	Chemical Resistant	PF5 Dust Mask
Double Layer PPE	Coveralls over above	Chemical Resistant	PF10 Half Face respirator with OVcartridges and P95 prefilters
Engineering Controls	No PPE is needed because closed systems are used for mixing/loading and closed cabs are used for application.		

Most of labels require the minimum use of a long-sleeved shirt, long pants, waterproof gloves, shoes and socks, chemically-resistant headgear for overhead exposure, and protective eyewear. In addition, the Conclude Ultra label specifies the use of coveralls over a short-sleeved shirt and short pants and chemically-resistant gloves (barrier laminate, nitrile rubber, neoprene rubber, viton) and chemically-resistant footwear. The use of both label required PPE and additional PPE has been presented in this risk assessment.

3.b.v. Occupational Handler Risk Assessments

The anticipated use patterns and current labeling indicate several exposure scenarios based upon the types of equipment (e.g., aerial and groundboom) that can potentially be used to make acifluorfen applications. These scenarios serve as the basis for the quantitative occupational handler non-cancer exposure and risk assessments. The following major occupational exposure scenarios were identified for acifluorfen:

- (1) mixing/loading liquids for aerial application;
- (2) mixing/loading liquids for groundboom application;
- (3) applying spray with fixed-wing aircraft;
- (4) applying spray with a groundboom sprayer;
- (5) mixing/loading/applying liquids for groundboom application; and
- (6) flagging aerial spray applications.

Please note that applications by chemigation systems are prohibited for acifluorfen products (per label instructions). The exposure scenarios for groundboom have been presented from studies in which individuals perform the following tasks: mix/load liquids, apply liquids, and mix/load/apply liquids. The workers in the chemical-specific study (MRID 42361501) did mixing/loading/applying all in the same replicates.

The occupational handler exposure and risk calculations for the above scenarios are presented in the following tables contained in Appendix B:

Table # - Title
B1 - Occupational Handler Exposure Scenario Descriptions for the Use of Acifluorfen
B2 - Unit Exposure Values for Occupational Handler Exposure to Acifluorfen
B3 - Baseline PPE Acifluorfen Occupational Non-Cancer Risk
B4 - Label Required PPE Acifluorfen Occupational Non-Cancer Risk
B5 - Single Layer PPE Acifluorfen Occupational Non-Cancer Risk
B6 - Baseline PPE Acifluorfen Occupational Cancer Risk
B7 - Label Required PPE Acifluorfen Occupational Cancer Risk
B8 - Single Layer PPE Acifluorfen Occupational Cancer Risk
B9 - Double Layer PPE Acifluorfen Occupational Cancer Risk
B10 - Engineering Control Acifluorfen Occupational Cancer Risk
B11 - Summary of Acifluorfen Non-Cancer Risk
B12 - Summary of Acifluorfen Occupational Cancer Risks for Private Growers
B13 - Summary of Acifluorfen Occupational Cancer Risks for Custom Applicators

All equations used for these calculations are included at the end of each table. Table B1 also summarizes the data quality of the MRID and PHED exposure data for each exposure scenario using grading criteria established by the PHED Task Force. All calculations were completed using current HED policies pertaining to the completion of occupational and residential exposure/risk assessments (e.g., rounding, exposure factors and acceptable data sources).

3.b.vi. Post Application Worker Exposure Data Sources

The following chemical-specific foliar dislodgeable residue study was submitted by BASF and was judged to be appropriate for use in HED post application exposure/risk assessments.

***EPA MRID 44091101**: Jackson, S. and J. Jordan. (1993) **Foliar Dislodgeable Residues of Blazer on Soybeans,** Unpublished study prepared by Pan-Agricultural Laboratories, Inc.**;**

*Memorandum: Review of Foliar Dislodgeable Residues of Blazer on Soybeans; dated 2/7/01 by Timothy C. Dole

This study measured dislodgeable foliar residues following groundboom application of acifluorfen - sodium to soybeans to control weeds was submitted by BASF to support the registration of acifluorfen-sodium. The formulation used was Blazer Herbicide, which is a soluble concentrate that contains 2 lb/gallon acifluorfen-sodium. This study was conducted at three sites located on farms in Indiana (IN), Mississippi (MS) and Georgia (GA). A wetting agent was also used during application. Two applications, 15 days apart, were made at each site. The target rates for the application were 0.125 and 0.375 lb/ai/acre to yield a total application of 0.5 lb ai/acre which is the maximum label rate per year. The finish spray was applied to the test sites

using tractor mounted boom sprayers. Two plots were established at each site, one treated and one untreated. The treated plot was divided into three subplots and the untreated into two subplots. The subplots were further divided into ten mini-plots for sampling.

Three samples at each site were collected before and after each application then approximately 1,3,5,7,10,14,21,28 and 35 days after the second application. Four soybean leaf disks were collected using 2.5 cm Birkestrand leaf punches from each of the ten miniplots to make the 40 disk sample which had a total surface area of 393 cm^2. Residues were dislodged in 100 ml of a 0.05% ivory soap solution using a reciprocal shaker at 200-250 cpm for ten minutes. Field spikes were prepared by collecting and dislodging leaf disks from the untreated plots in the same manner as the samples collected from the treated plots. Separate Birkestrand punches were used for the treated and untreated samples at each site.

Dislodgeable foliar samples were analyzed using a specific BASF Method that involves Gas Chromatography with electron capture of the acifluorfen ester and HPLC of the Acifluorfen Amine. The method along with validation data was included in the study report. The LOQ was determined to be 0.0125 ug/cm based upon a recovery of 93.6 $\pm$ 18.4 percent (n=3) for acifluorfen and 81.6 $\pm$ 4.5 percent (n=3) for acifluorfen amine at the lowest fortification level of 0.0125 ug/cm^2. The laboratory recoveries averaged 99.3 $\pm$ 9.6 percent (n=60) for acifluorfen and 92.9 $\pm$ 15.6 percent (n=56) for acifluorfen amine. Laboratory fortifications ranged from the LOQ to 5.1 ug/cm^2.

The average recoveries for 12 field spikes fortified at each site with 0.125 ug/cm^2 acifluorfen was 121.9 $\pm$ 16.2 percent (N=36). The recoveries for the individual sites were similar to the average recovery. The average recoveries for acifluorfen amine were 20 percent for IN, 12 percent for GA and 78 percent for MS.

The DFR data is given in Table 7 and indicate that the Georgia site had the lowest DAT 0 DFR. The Indiana site declined to the LOQ by DAT 9 while the Georgia and Mississippi sites declined to the LOQ by DAT 3. The DAT 2 data was 1-2X the LOQ in Georgia and 8X the LOQ for Mississippi. No acifluorfen sodium residue was detected prior to either the first or second application at any of the sites. The DFR level for acifluorfen amine was <0.013 ug/cm^2 at all of the sites on day zero following the first and second applications. The DFR levels for the controls were below the LOQs for both acifluorfen and acifluorfen amine.

This study was to be of sufficient quality to be used for exposure and risk assessment purposes and the product was applied in a manner consistent with the label. The DFR data for the Indiana and Mississippi sites were used for the calculations of Post Application exposures and risks. The Georgia data were not used because DAT 0 values were substantially less than the Indiana and Mississippi DAT 0 values.

Table 7 - Dissipation of Acifluorfen Applied to Soybeans					
Site	**Application Rate (lb ai/acre)**	**Day 0 DFR (ug/cm^2)**	**Average Transfer Efficiency (n=2)**	**Correlation Coefficient (R)**	**Half Life (days)**
Indiana	0.125 + 0.375	0.68 ± 0.12	21 ± 7.8%	0.97 (n=18)	1.4
Georgia	Same as above	0.22 ± 0.073	15 ± 7.1%	0.87 (n=9)	0.72
Mississippi	Same as above	0.74 ± 0.12	18 ± 1.4%	0.99 (n=9)	0.45

3.b.vii. Post-Application Worker Risk Assessments

The Agency has determined that workers may be exposed to acifluorfen during scouting, hand weeding and irrigating of fields which have been previously treated with acifluorfen. Due to the frequency and duration of these exposures coupled with the rapid dissipation of acifluorfen following applications, it was determined that these exposures would be short-term and intermediate-term in duration and would occur primarily through the dermal route. Potential inhalation exposures are not anticipated for post-application worker exposures, and the Agency currently has no policy/method for evaluating non-dietary ingestion by workers due to poor hygiene practices or smoking. As a result, only dermal exposures were evaluated in the post-application worker assessment. The Agency anticipates that all harvesting of peanuts, rice and soybeans will be performed mechanically and that the residues will have dissipated.

A restricted entry interval (REI) is defined as the duration of time which must elapse before residues decline to a level so entry into a previously treated area and engaging in a specific task or activity would not result in exposures which exceed the Agency's level of concern. Equations were previously described in Section 3.b.i.

Transfer coefficients are a measure of the relationship between exposure to dislodgeable foliar residues (DFRs) and exposure level measured while engaged in a specific activity or job function (e.g., scouting or irrigating). Transfer coefficients are used to estimate potential human exposure. The values assigned by the Science Advisory Council on Exposure for dermal transfer coefficients represent estimates of potential exposure contact during specified tasks. These standard transfer coefficients will be in use until the Agriculture Re-entry Task Force (ARTF) provides the Agency activity-specific transfer coefficients. Table 8 summarizes the standard transfer coefficients and activities along with the specific crops and application rates addressed in the post-application worker assessment.

Table 8 - Post-Application Potential Dermal Transfer Coefficients				
Transfer Coefficient Group	**Activities**	**Transfer Coefficient (cm^2/hr)***	**Foliage Development**	**Comments**
Field/row crops, low/medium (includes soybeans rice and peanuts)	Hand Weeding	100	Full	Central value from MRID 426891 - hoeing in cotton and beans.
Field/row crops, low/medium (includes soybeans rice and peanuts)	Irrigate and Scout	1500	Full	Central value from ARTF 021 - Scouting Dry Peas.

* Standard values for transfer coefficients are from HED Exposure Science Advisory Council (SAC) Policy #3.1 dated August 7, 2000.

Estimated occupational exposures and cancer risks for scouting and irrigating peanuts, rice and soybeans were calculated. The equations used in these calculations and the results are presented in the following tables and spreadsheets contained in Appendix C:

Table # - Description
Table C1 - Summary of Estimated Occupational Post-Application Cancer Risks for Acifluorfen
Spreadsheet C2 - Acifluorfen Cancer Risks Based Upon Indiana DFR Data
Spreadsheet C3 - Acifluorfen Cancer Risks Based Upon Mississippi DFR Data
Spreadsheet C4 - Acifluorfen Non-Cancer Risks Based Upon Indiana DFR Data
Spreadsheet C5 - Acifluorfen Non-Cancer Risks Based Upon Mississippi DFR Data

3.b.viii. Residential Applicator Data Sources and Risk Assessments

HED has determined from residential use patterns and current labeling that residential pesticide applicators (i.e. homeowners) are likely to be exposed during acifluorfen use as a spot treatment to kill weeds and that this use would result in short-term exposures. This scenario will serve as the basis for the quantitative exposure and risk assessments:

- (1) Spot Treat Weeds Using RTU Trigger Sprayer

Data Sources

Exposure data for this scenario was taken from the following study which was submitted by Aventis Corp. in support of the reregistration of carbaryl:

- **Carbaryl Mixer/Loader/Applicator Exposure Study during Application of RP-2 Liquid (21%) Sevin (r) Ready to Use Insect Spray or Sevin 10 Dust to Home Garden Vegetables.** Agrisearch Study No. 1519. EPA MRID 444598-01. Report dated August 22, 1998, Author; Thomas C. Mester, PhD., Sponser: Rhone Poulenc Ag Company

This study involved low pressure handwand and RTU trigger sprayer application of Sevin(r) which contains 21% carbaryl to home vegetable plants. Applications were made by volunteers to two 18 foot rows of tomatoes and one 18 four foot row of cucumbers at a test field in Florida. A total of 40 replicates were conducted. Latex gloves were worn for twenty of the replicates and no gloves were worn for the other twenty replicates. Each replicate opened the end use product and applied it to the vegetable rows, after which the dosimeters were collected. Inhalation exposure was monitored in the breathing zone with personal air sampling pumps and OVS sampling tubes. Dermal exposure was monitered by the extraction of carbaryl from inner and outer cotton full body dosimeters, face neck wipes, and glove and hand washes.

The average field fortification recoveries for the full body dosimeters were 84.3% for the inner and 77.7 % for the outer. Face/neck wipe field recoveries were 84.8% and handwash and OVS tube field recoveries were greater than 90 %. Laboratory method validation for each sampling matrix fell within the acceptable range of 70 % to 120%. The limit of quantitation (LOQ) was 1.0 ug/sample for all media except the OVS tubes where the LOQ was 0.01 ug/sample.

Dermal exposure was determined by adding the values from the bare hand rinses, face/neck wipes, outer dosimeter lower legs and arms, inner dosimeter torso and inner dosimeter upper legs and upper arms. This accounts for the residential applicator wearing a short sleeved shirt and short pants. The unit exposures are presented in Table 9.

Table 9 - Unit Exposure Values For Trigger and Pump Sprayer Application (MRID 444598-01)

Scenario	Dermal Unit Exposure (mg/lb ai handled)			Inhalation Unit Exposure (ug/lb ai handled)		
	Average	Geo. Mean	Median	Average	Geo. Mean	Median
Trigger Sprayer	80	53	53	0.096	0.067	0.034
Hand Held Pump Sprayer	56	38	35	0.012	0.030	0.011

Residential Applicator Risk Assessments

The residential pesticide applicator exposure and risk calculations are presented in the tables contained in Appendix D. All of the equations used in these tables are summarized at the end of the tables and in *Section 3.b.i* of this document. Table D4 of Appendix D summarizes the parameters and caveats specific to the exposure data used for the exposure scenario. These caveats include a description the data source and quality. Generally, the assessment of the data is based upon the number of observations and the available quality control data. Quality control data are assessed based upon a grading criteria established by the PHED Task Force.

It is important to note that the study values represent an applicator wearing typical residential clothing of short-sleeved shirt, short pants and no gloves. Homeowner uses are not covered by the Worker Protection Standard. The Agency does not have the legal authority to require the use of PPE and/or engineering controls for residential applicators, therefore, the use of PPE and/or engineering controls is not considered in the residential applicator risk assessment.

3.c. Occupational and Residential Risk Characterization

The occupational and residential non-cancer and cancer risk assessments are summarized herein. Please refer to the appropriate tables as stated in the text. These tables are the basis for the risk assessments.

3.c.i. General Risk Characterization Considerations

The following issues should be considered when interpreting the results of this exposure assessment:

- Measured and estimated exposures occurred primarily by the dermal route. The inhalation exposures typically accounted for only 1-5 % of the total baseline exposure.
- The unit exposure values are based upon measures of central tendency such as the geometric and arithmetic mean. Maximum application rates as listed on the labels were used for non-cancer risk estimates and average application rates were used for cancer risk estimates. The daily acres treated are high end values for non-cancer risk estimates and average values for cancer risk estimates.

3.c.ii. Occupational Handler/Applicator Risk Characterization

Non-Cancer Results

The calculations of non-cancer risks indicate that two exposure scenarios are below 100 at the baseline level and exceed HED's level of concern. These scenarios are the mixing and loading of liquids for aerial and groundboom applications. All of the remaining exposure scenarios at the baseline and higher levels of mitigation are above 100 and do not exceed the Agency's level of concern. Table 10 summarizes the ranges of combined MOEs for the various exposure scenarios.

Table 10 - Non-Cancer Combined MOEs for Occupational Exposure to Acifluorfen

	Baseline	Label Required PPE	Single Layer PPE	Double Layer PPE	Engineering Controls
Combined MOE Range	4.6 - 27,000	420 - 27000	430 - 32,000	N/A	N/A

A brief summary of the specific exposure scenarios which exceeded the Agency's level of concern (i.e. combined MOEs less than 100) is presented below. Please refer to Appendix B for a more detailed summary of the combined MOEs for each exposure scenario.

Baseline Exposure Scenarios with Combined MOEs less than 100

(1) mix/load liquids for aerial application at all application rates.
(2) mix/load liquids for groundboom application at the higher application rates

Label Required PPE Scenarios with Combined MOEs less than 100

None

Single Layer PPE Scenarios with Combined MOEs less than 100

None.

Non- Cancer Risks of Concern for Occupational Handlers/Applicators

The calculations of non-cancer risks indicate that, at the label required PPE level or above, all of the scenarios have combined MOEs above 100. Therefore, there are no non-cancer risks of concern for occupational handlers/applicators.

Data Gaps for Private Grower and Custom Pesticide Applicator Scenarios

There are no data gaps for the exposure scenarios presented in this assessment. However, the Agency requires additional information regarding chemical-specific use information for acifluorfen which establishes if one individual performs mixing/loading/applying tasks for groundboom applications or if more than one individual performs these tasks. It is critical that the Agency obtain chemical-specific use information for both individual and custom pesticide applicators.

Cancer Results

The cancer risk calculations for private grower and custom handler/applicator indicate that one exposure scenario (mixing/loading liquids for aerial application) exceeds 1.0×10^{-4} at the baseline level. All of the remaining exposure scenarios at the baseline and higher mitigation levels do not exceed 1.0×10^{-4}. None of the private grower scenarios exceed 1.0×10^{-6} with label required PPE. Approximately half of the custom applicator scenarios exceed 1.0×10^{-6} with label required and single layer PPE while only one scenario exceeds 1.0×10^{-6} with double layer PPE. None of these scenarios exceed 1.0×10^{-6} with engineering controls. Table 11 summarizes the cancer risks for private grower and custom applicators.

Table 11 - Cancer Risks for Private Growers and Custom Handlers/Applicators					
Cancer Risk	**Baseline**	**Label Required PPE**	**Single Layer PPE**	**Double Layer PPE**	**Engineering Controls**
Private grower	3.5×10^{-8} to 2.5×10^{-5}	3.5×10^{-8} to 3.8×10^{-7}	2.9×10^{-8} to 3.7×10^{-7}	2.3×10^{-8} to 1.1×10^{-7}	2.2×10^{-9} to 7.8×10^{-8}
Custom Applicator	3.5×10^{-7} to 2.5×10^{-4}	3.5×10^{-7} to 3.8×10^{-6}	2.9×10^{-7} to 3.7×10^{-6}	2.3×10^{-7} to 1.5×10^{-6}	2.2×10^{-8} to 7.8×10^{-7}

A brief summary of the specific exposure scenarios which exceeded the Agency's level of concern (i.e. cancer risk greater than 1.0×10^{-4}) is presented below. A more detailed summary is provided in Appendix B.

Baseline Exposure Scenarios with cancer risk greater than 1.0×10^{-4} (Private grower)

None

Baseline Exposure Scenarios with cancer risk greater than 1.0×10^{-4} (Custom Applicator)

(1) mixing/loading liquids for aerial application (2.5×10^{-4})

Single Layer PPE Scenarios with cancer risk greater than 1.0×10^{-4} (Private and Custom)

None.

Double Layer PPE Scenarios with cancer risk greater than 1.0×10^{-4} (Private and Custom)

None.

Engineering Control Scenarios with cancer risk greater than 1.0×10^{-4} (Private and Custom)

None.

Private grower and/or Custom Applicator Scenarios of Concern

The calculations of cancer risks indicate that, at the highest level of mitigation available and/or feasible for a specific scenario, all of the scenarios have cancer risks less than 1.0×10^{-4} for both private grower and custom handlers/applicators. Therefore, there are no cancer risks of concern.

3.c.iii. Post-Application Worker Risk Characterization

Non-Cancer Results

Table 12 summarizes the estimated MOEs for workers scouting weeds and irrigating peanuts, rice and soybeans. The calculations indicate that the MOEs are greater than 100 on day zero for both private growers and professional workers. It should be noted that the MOEs are the same for private growers and professional farm workers because the MOEs are based upon a short term endpoint and are not affected by the number of exposure days. The current REI for acifluorfen is 48 hours based on acute eye irritation (toxicity category I).

Table 12 - Estimated Acifluorfen Post-Application Exposures and Non-Cancer Risks

Exposed Person	Application Rate (lb ai/A)	Transfer Coefficient (cm^2/hr)[a]	Activities	MOE on Day 0*
Based Upon DFR Data for Indiana (MRID 440911-01)				
Private growers and Commercial Farm Workers	0.375	1500	Irrigate and Scout -Medium Exposure	740
Based Upon DFR Data for Mississippi (MRID 440911-01)				
Same as above	0.375	1500	Irrigate and Scout - Medium Exposure	680

* The MOEs on day zero are greater than 100 and are, therefore, not of concern.

Cancer Results

Table 13 summarizes the private grower and professional worker post-application cancer risks for scouting and irrigating soybeans, peanuts and rice treated with Acifluorfen. None of the post-application cancer risks exceed 1.0×10^{-4} for day 0 exposures.

Table 13 - Estimated Post-Application Cancer Risks.

Exposed Person	Application Rate (lbs ai/acre)	Annual # Days Irrigation and Scouting	Cancer Risk on Day of Application (Day 0)	Day on which Cancer Risk is less than 1×10^{-6}
Using Indiana DFR Data from MRID 440911-01.				
Private Owner Professional	0.250	2 20	5.4×10^{-7} 5.4×10^{-6}	0 4
Using Mississippi DFR data from MRID 440911-01.				
Private Owner Professional	0.250	2 20	5.9×10^{-7} 5.9×10^{-6}	0 2

3.c.iv. Residential Applicator Risk Characterization

The residential exposure scenario yielded a combined MOE of 18000 while the target MOE is 1000 due to the FQPA safety factor for females 13-50 years of age. In addition, a cancer risk of 4.5×10^{-8} was calculated for this scenario which is below HED's level of concern (1.0×10^{-6}) for the general population.

The following exposure facts and assumptions were made for the cancer risk assessment:

1) The residential acifluorfen products contain 0.12% acifluorfen.
2) Container sizes range from 24 ounces to one gallon and include a quick connect sprayer.
2) Residential applicators would make 2 spot treatment applications of acifluorfen in one year,
3) Each spot treatment application would use half a gallon of acifluorfen product;
4) Residential applicators may have 50 years of potential exposure over a 70 year lifespan.

It should be noted that cancer risk is calculated on an annual basis and does not depend upon the amount used in any one day. These calculations indicate that cancer risks will not exceed 1.0×10^{-6} if amount used per year does not exceed twenty two gallons.

3.d. Incident Reports

The incident report was developed under a separate memo by Monica Spann, M.P.H. through Jerome Blondell, PhD. of the Office of Pesticide Programs (DP Barcode #264815 of 4/6/00). No information is available on incidents related to the use of sodium acifluorfen from any of the available data sources consulted by the Health Effects Division. Little or no usage has been reported for this pesticide, either in nationwide surveys of home use or in California surveys of agricultural use. In addition, on the list of the top 200 chemicals for which the National Pesticide Telecommunication Network received calls from 1984-1991 inclusively, sodium acifluorfen was not reported to be involved in human incidents.

3.e. Information and Data Needs

Several areas of the risk assessment and characterization would improve with more information and data. Areas of information and data needs include:

- The agency requests additional dermal absorption data to refine the dermal absorption factor of 20 percent which was derived from a 1986 rat study. This study indicated that 1 to 43.5 percent of the applied dose remained on the skin following a ten hour exposure period and subsequent washing with distilled water.
- The agency requests additional pharmacokinetic data to interpret the biomonitoring study.

Appendix A - Use Closure Memo for Sodium Acifluorfen

MEMORANDUM

To: Sodium Acifluorfen RED Team Members

From: Christina Scheltema,
Special Review and Reregistration Division

Subject: Sodium Acifluorfen Use Closure Memo

For the purposes of conducting human health and ecological risk assessments, the members of the sodium acifluorfen RED team should use the same assumptions. Historically, the health and ecological exposure assessments have used the maximum label rate to determine potential exposures. However, both typical and maximum label rates may now be considered in the human health and ecological risk assessments.

As a result of the March 11, 1999 SMART meeting and subsequent communications between the RED team members and the registrant, this memorandum will act as the Agency's record of common understanding on the uses of sodium acifluorfen to be used in risk assessments, including all product information; agricultural/ornamental uses; deleted uses; the status of the existing database; and the schedule for completion of draft chapters. The final version of this memo incorporates comments received from HED and EFED. In addition to this memorandum, RED packages consisting of an updated CRMS report, LUIS report, and bibliography have been distributed to the RED team. HED and EFED are using data for their risk assessment from the following sources: (1) information provided by the registrant on usage of various agricultural commodities and ornamentals; (2) labels; and (3) the LUIS report.

The QUA (Quantitative Usage Analysis) prepared for sodium acifluorfen is also considered to be part of this memo. The QUA contains the percent crop treated for the dietary risk assessments.

A draft of this memo was reviewed by BASF. Their comments were included as appropriate.

FORMULATIONS

The following sodium acifluorfen formulations will be included in the Agency's reregistration risk assessment:

Formulation	EPA Registration Number	Lbs ai/gal	Comments
Blazer (BASF)	7969-79	2.0	Stand Alone Formulation
Blazer 2S (BASF)	7969-80	2.0	Dormant product* overseas use only
Blazer MUP (BASF)	7969-87	2.0	Technical
Storm (BASF)	7969-76	1.33 (+2.67 lbs Bentazon)	Acifluorfen/Bentazon Premix
Galaxy (BASF)	7969-77	0.67 (+3.0 lbs Bentazon)	Acifluorfen/Bentazon Premix
Conclude Xtra	7969-76	1.33 (+2.67 lbs Bentazon)	Copack product (Storm + Clethodim) Dormant product*
Conclude Ultra (BASF)	7969-168	0.84 (+1.69 lbs Bentazon)	Copack product (Storm + Sethoxydim)
Manifest (BASF)	7969-77	0.67 (+3.0 lbs Bentazon)	Copack product (Galaxy + Poast)Dormant product*
KleenUp, Dead-N-Gone Grass and Weed Killer (Platte Chemical Co. under transfer to Bonide)	34704-774	0.12% (+0.50 % glyphosate)	Ready to Use Acifluorfen/ Glyphosate Formula for Homeowner use
KLEENUP Grass and Weed Killer (Monsanto)	71995-3 (formerly 239-2509)	0.12% (+0.50% glyphosate)	Ready to Use Acifluorfen/ Glyphosate Formula for Homeowner use
Status (American Cyanamid)	241-321	2.0	Stand Alone Formulation Dormant product*
Scepter OT (American Cyanamid)	241-321	2.0 (+0.5 lbs Imazaquin)	Acifluorfen + Imazaquin,

* Use will not be marketed but will be retained on labels. BASF is aware that OPP must include these products in the risk assessment. BASF has made a business decision to support the dormant products.

ESTABLISHED TOLERANCES

Tolerances have been established for sodium acifluorfen on the following commodities:

Cattle, goat, Hog, Horse Kidney, Liver	0.02 ppm
Poultry fat, meat byproducts	0.02 ppm
Poultry Meat, Eggs	0.02 ppm
Milk	0.02 ppm
Soybeans	0.1 ppm
Peanuts	0.1 ppm
Peanut Hulls	0.1 ppm
Rice Grain	0.1 ppm
Rice Straw	0.1 ppm
Strawberries	0.05 ppm

The strawberry tolerance was developed for IR-4. At present, sodium acifluorfen is not registered for use on strawberries under either FIFRA section 3 or section 24(c). IR 4 developed data to support the strawberry tolerance because acifluorfen was a potential methyl bromide replacement. Acifluorfen was proposed for use in renovating strawberry beds in California. Residue chemistry data to support the strawberry tolerance were developed when acifluorfen had higher maximum label rates than at present. Since that time, the technical registrant has lowered the maximum label rate for sodium aciflourfen, and the new maximum rate is lower than the rate supported by IR-4 for strawberries. IR-4 has expressed renewed interest in pursuing a California registration for sodium acifluorfen on strawberries. However, the California registration is not expected to occur until after the RED is finalized. Further, BASF canceled the California registration of acifluorfen and has no plans to reinstate it.

USE AND USE SITES

Sodium acifluorfen is used as a post emergent herbicide to control a variety of weeds. BASF claims there is no residual herbicide activity at the current rates, which range from 0.125 to 0.375 lbs ai/A. Sodium acifluorfen is typically applied with spray adjuvants (crop oil or ionic surfactant) for improved leaf cuticle penetration. Sodium acifluorfen is typically applied when weeds are small (< 4 " tall), when acifluorfen is more effective at low rates. Aciflurofen is used as part of a total weed management program. Use sites and maximum and typical use rates are given in the following table.

Crop/Formulation	Maximum Application Rate, lbs ai/A	Typical Application Rate per Acre per Season, lbs ai/A	Maximum Rate per Acre per Season, lbs ai/A
Peanuts			
Blazer	0.375	0.250	0.500
Storm	0.250	0.250	0.500
Soybeans			
Blazer	0.375	0.188	0.500
Storm	0.250	0.250	0.500
Conclude/Ultra B	0.158	0.158	0.158
Conclude Xtra B	0.250	0.250	0.250
Galaxy	0.250	0.168	0.250
Manifest	0.168	0.168	0.168
Scepter OT	0.250	0.250	0.500
Status	0.375	0.188	0.500
Rice			
Blazer	0.250	0.125	0.250
Storm	0.250	0.250	0.250
Lawns (Monsanto)			
KleenUp Grass and Weed Killer	Spot treatment	Spot treatment	Spot treatment

RE-ENTRY INTERVAL

The present re-entry interval (REI) for sodium aciflourfen is 48 hours, based on a signal word ("danger").

GROUNDWATER ADVISORY

There is a groundwater advisory statement for sodium aciflourfen on all labels. This is based on the results of prospective groundwater studies for sodium acifluorfen, which showed that acifluorfen may leach to groundwater under some circumstances.

STATUS OF DATABASE

The database for sodium aciflourfen is substantially complete. A few studies are currently in review.

QUANTITATIVE USAGE ANALYSIS

The Biological and Economic Effects Division (BEAD) performed a quantitative usage analysis (QUA) for sodium acifluorfen. This report contains information on percent crop treated to be used in the risk assessment. The original BEAD report is appended.

Quantitative Usage Analysis for Acifluorfen

Case Number: 2605 PC Code: 114402
Date: August 9, 1998 Analyst: Frank Hernandez

Based on available pesticide survey usage information for the years of 1987 through 1998, an annual estimate of acifluorfen total domestic usage averaged approximately one and a half million pounds active ingredient (a.i.) for over six million acres treated. Acifluorfen is a herbicide with its largest markets in terms of total pounds active ingredient allocated to soybeans (93%), peanuts (4%), and rice (2%). Most of the usage is in AR, MS, IL, MO, IN, NC, VA, TX, and AL.

Site	Acres Grown (000)	Acres Treated (000)		% of Crop Treated		LB AI Applied (000)		Average Application Rate			States of Most Usage
		Wtd Avg	Est Max	Wtd Avg	Est Max	Wtd Avg	Est Max	lb ai/ acre/yr	#appl / yr	lb ai/ A/appl	(% of total lb ai used on this site)
Idle Cropland	7,461	255	299	3.41775	4.007	0.057	299	0	1.0	0	IA 100%
Lots/Farmsteads/etc	24,815	1	498	0.004	2.005	0	132	0	1.0	0	AR LA MN 100%
Other Crops	2,515	16	132	0.63607	5.248	0.0106	132	0	2.0	0	MN 100%
Peanuts	1,610	180	307	11.1942	19.04	0.18657	113	0	1.2	0	NC GA VA TX AL MS 85%
Rice	2,921	119	183	4.0692	6.267	28	48	0.2383	1.1	0.21589	AR MS MO 90%
Setaside Acres	21,802	4	661	0.0204	3.033	1	149	0.2249	1.1	0.20489	AR SC 100%
Soybeans	62,879	5,771	7,257	9.17731	11.54	0.15296	0.192	0	1.1	0	AR MS IL MO MN IN 60%
Woodland	62,825	0	1	0	0	0	0	0	1.0	0	SC 100%
Total		6,346	7,842			1,462	2,022				

COLUMN HEADINGS

Wtd Avg = Weighted average--the most recent years and more reliable data are weighted more heavily.
Est Max = Estimated maximum, which is estimated from available data.
Average application rates are calculated from the weighted averages.

NOTES ON TABLE DATA

Usage data primarily covers 1987 - 1996. Calculations of the above numbers may not appear to agree because they are displayed as rounded to the nearest 1000 for acres treated or lb. a.i. (Therefore 0 = < 500) to two decimal percentage points for % of crop treated.

Other/Crop Groups Other Crops include ornamentals, popcorn, rapeseed/canola, and safflower.

SOURCES: EPA data, USDA, and National Center for Food and Agricultural Policy.

APPENDIX B

SODIUM ACIFLUORFEN
OCCUPATIONAL EXPOSURE AND RISK ASSESSMENT TABLES

Table B1: Occupational Handler Exposure Data Source Descriptions for the Use of Sodium Acifluorfen.

Exposure Scenario (Number)	Data Source	Comments[f]
(1 and 2) Mix/Load Liquids	PHED V1.1	**Baseline**[a]: Hand and dermal data are AB grades, and inhalation data are AB grades. Non- glove hand data =53 replicates; Dermal = 72 to 122 replicates; and inhalation = 85 replicates. High confidence in hand/dermal and inhalation data. No protection factor was needed to define the unit exposure. **Label Required PPE**[b] The same dermal data are used as for baseline. Gloved hand data are AB grades, replicates = 59. The same inhalation data are used as for the baseline. **Single Layer PPE**[c]: The same dermal data are used as for baseline. Gloved hand data are AB grades, replicates = 59. The same inhalation data are used as for the baseline with an 80% protection factor to simulate the use of a dust/mist respirator. **Double Layer PPE**[d]: The same dermal data are used as for baseline with a 50% protection factor to account for the use of an additional layer of clothing (i.e., coveralls or Tyvek suit). The same inhalation data are used as for the baseline with 90% protection factor to account for the use of a half-face negative pressure respirator with organic vapor cartrdges and pesticide pre-filters. **Engineering Controls**[e]: Hand and dermal unit exposure are AB grades. Hand = 31 replicates; and dermal = 16 to 22 replicates. High confidence in dermal and hand data. Inhalation data are AB grade; replicates = 27. High confidence in inhalation data.
(3) Apply Spray with Fixed-Wing Aircraft	PHED V1.1	**Baseline (Closed Cab)**[g] Hands = AB grade, dermal and inhalation=ABC grade. Hands=34 replicates; dermal =24 to 48 replicates, and inhalation =23 replicates. Medium Confidence in dermal and inhalation data; high confidence in hand data. No protection factor was needed to define the unit exposure value.
(4) Apply with Groundboom Sprayer	PHED V1.1	**Baseline:** Hand, dermal, and inhalation data = AB grades. Non-gloved hand = 29 replicates; dermal = 23 to 42 replicates; and inhalation = 22 replicates. High confidence in hand/dermal and inhalation data. No protection factor was needed to define the unit exposure value. **Label Required PPE:** The same dermal data are used as for baseline. Gloved hand data are ABC grades, with 21 replicates, and medium confidence level. The same inhalation data are used as for baseline. **Single Layer PPE:** The same dermal data are used as for baseline. The same inhalation data are used as for baseline with an 80% protection factor to simulate the use of a dust/mist respirator. Hand data are ABC grades, with 21 replicates, and medium confidence level. **Double Layer PPE**: The same dermal data are used as for baseline with a 50% protection factor to account for the use of an additional layer of clothing (i.e., coveralls or Tyvek suit). Hand data are ABC grades with 21 replicates and and a medium confidence level. The same inhalation data are used as for the baseline with 90% protection factor to account for the use of a half-face negative pressure respirator with organic vapor cartrdges and pesticide pre-filters. **Engineering Controls**: Hand and dermal unit exposure are ABC grades. Hand =16 replicates; and dermal = 20-31 replicates. Medium confidence in dermal and hand data. Inhalation data are AB grade; replicates =16. High confidence in inhalation data. Gloves not worn.
(5) Mix/Load/Apply Liquids - Groundboom	MRID 423615-01	**Label Required PPE:** Gloved Hand Data=AB grade. Dermal data = ABC grade. Inhalation data = AB grades. Hand = 15 replicates; dermal = 15 replicates; and inhalation = 14 replicates. High confidence in hand data. Medium confidence in dermal data from dosimeters positioned under clothing. Low confidence in dosimeters positioned outside of clothing due to low recovery from sun exposed dosimeter pads. Low confidence in inhalation data because the air sampling tubes did not contain filters for collection of the aerosol phase. Gloves and long sleeve shirts over T shirts were worn during the study. Respirators were not worn during the study. **Single Layer PPE:** The same dermal and hand data are used as for label required PPE. The same inhalation data are used as for single layer PPE with an 80% protection factor to simulate the use of a dust/must respirator.

Exposure Scenario (Number)	Data Source	Comments[f]
(6) Flag Aerial Spray Applications	PHED V1.1	**Baseline:** Hands, dermal and inhalation AB grades. Dermal =18 to 28 replicates; Non-gloved hands =30 replicates; and inhalation=28 replicates. High confidence in dermal, hand, and inhalation data. **Label Required PPE**: The same dermal data are used as for baseline. Gloved hand data are AB grades with 6 replicates and low confidence. The same inhalation data are used as for baseline. **Single Layer PPE**: The same dermal data are used as for baseline. Gloved hand data are AB grades with 6 replicates and low confidence. The same inhalation data are used as for baseline coupled with a 80% protection factor to simulate the use of a dust/mist respirator. **Double Layer PPE**: The same dermal data are used as for baseline with a 50% protection factor to account for the use of an additional layer of clothing (i.e., coveralls or Tyvek suit). The same inhalation data are used as for the baseline with 90% protection factor to account for the use of a half-face negative pressure respirator with organic vapor cartrdges and pesticide pre-filters. **Engineering Controls**: The same data are used as for baseline with a 98% protection factor to simulate closed cab.

Notes

a Baseline PPE - long pants, long sleeved shirt, no gloves, no respirator, open mixing/loading, open cab tractor for groundboom applications, and open flagging.

b. Label Required PPE - Same as Baseline PPE with chemical resistant gloves

c Single Layer PPE - chemical resistant gloves, long pants, long sleeved shirt, hat and a PF5 dust/mist respirator.

d Double Layer PPE - Includes coveralls, chemical resistant gloves and a PF10 respirator with organic vapor cartridges and dust/mist prefilters

e Engineering Controls - Includes closed mixing/loading and/or enclosed cab application

f These grades are based on Quality Assurance/Quality Control data provided as part of the exposure studies. A replicate refers to data acquired during one complete work cycle. All handler exposure assessments in this document are based on the "Best Available" data as defined by HED SOP for meeting Subdivision U Guidelines (i.e., completing exposure assessments.) Best available grades are assigned as follows: matrices with grades A and B data (which is defined as acceptable grade data) and a minimum of 15 replicates; if not available, then grades A, B, and C data and a minimum of 15 replicates; if not available, then all data (all grades) regardless of the quality and number of replicates. High quality data with a protection factor take precedence over low quality data with no protection.
Data confidence as reported in the Table refers to both the quality and the quantity (number of replicates) of data for each PHED run. Each study in PHED has been graded from A to E. A high confidence run yields grades A and B data and 15 or more replicates per body part. Any combination of A and B grade data are listed as acceptable grades data in the tables. A medium confidence run yields grades A, B, and C data and 15 or more replicates per body part. Any combination of A, B, and C grade data are listed as ABC grade data in the tables. A low confidence run yields all grades (any run that includes D or E grade data) or has less than 15 replicates per body part.

g. Aerial application is typically done using a closed cockpit airplane while wearing a single layer of clothing without gloves.

Table B2: Unit Exposure Values for Occupational Handler Exposure to Sodium Acifluorfen.

Exposure Scenario	Baseline PPE Unit Exposure Values		Label Required PPE Unit Exposure Values		Single Layer PPE Unit Exposure Values		Double Layer PPE Unit Exposure Values		Engineering Controls Unit Exposure Values	
	Dermal (mg / lb ai handled)	Inhalation (µg / lb ai handled)	Dermal (mg / lb ai handled)	Inhalation (ug/lb ai handled)	Dermal (mg / lb ai handled)	Inhalation (ug/lb ai handled)	Dermal (mg / lb ai handled)	Inhalation (µg /lb ai handled)	Dermal (mg / lb ai handled)	Inhalation (µg / lb ai handled)
(1) Mix/Load Liquids for Aerial Application	2.9	1.2	0.023	1.2	0.023	0.24	0.017	0.12	0.0086	0.083
(2) Mix/Load Liquids for Groundboom Application	2.9	1.2	0.023	1.2	0.023	0.24	0.017	0.12	0.0086	0.083
(3) Apply Spray with Fixed-Wing Aircraft	0.005	0.068	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
(4) Apply Spray with a Groundboom Sprayer	0.014	0.74	0.014	0.74	0.014	0.15	0.011	0.074	0.0050	0.043
(5) Mix/Load/Apply Liquids -Groundboom (MRID 423615-01)	N/A	N/A	0.185	1.2	0.185	0.24	N/A	N/A	N/A	N/A
(6) Flag Aerial Spray Applications	0.011	0.35	0.012	0.35	0.012	0.070	0.011	0.035	0.00022	0.007

Table B3: Baseline Clothing Acifluorfen Worker Exposure and Non -Cancer Risks

Exposure Scenario	Application Rates[a] (lb ai/Acre)	Treated Areas[b] (Acres/day)	Daily Exposure (mg/day)[c]		Absorbed Daily Dose (mg/kg/day)[d]		Combined Absorbed Daily Dose (mg/kg/day)[e]	Combined MOEs[f]
			Dermal	Inhalation	Dermal	Inhalation		
(1) Mix/Load Liquids for Aerial Application	0.158	350	160	0.066	0.53	0.00111	0.54	**37**
(1) Mix/Load Liquids for Aerial Application	0.375	1200	1305	0.54	4.35	0.00900	4.4	**4.6**
(2) Mix/Load Liquids for Groundboom Application	0.158	80	36.7	0.015	0.12	0.00025	0.12	163
(2) Mix/Load Liquids for Groundboom Application	0.375	200	218	0.090	0.73	0.00150	0.73	**28**
(3) Apply Spray with Fixed-Wing Aircraft	0.158	350	0.28	0.0038	0.00092	0.00006	0.0010	20318
(3) Apply Spray with Fixed-Wing Aircraft	0.375	1200	2.3	0.031	0.0075	0.00051	0.0080	2497
(4) Apply Spray with Groundboom Sprayer	0.158	80	0.18	0.0094	0.0006	0.00016	0.0007	26818
(4) Apply Spray with Groundboom Sprayer	0.375	200	1.1	0.056	0.0035	0.00093	0.0044	4520
(5) Mix/Load/Apply - Groundboom	0.158	80	N/A	N/A	N/A	N/A	N/A	N/A
(5) Mix/Load/Apply - Groundboom	0.375	200	N/A	N/A	N/A	N/A	N/A	N/A
(6) Flagging Aerial Applications	0.158	350	0.61	0.019	0.0020	0.00032	0.0024	8510
(6) Flagging Aerial Applications	0.375	1200	5.0	0.16	0.0165	0.00263	0.0191	1046

Notes

a Application rates are minimum and maximum values found in Sodium Acifluorfen Use Closure Memo.

b Amounts of acreage treated per day are maximum values from the HED Science Advisory Council for Exposure Policy #009 " Standard Values for Daily Acres Treated in Agriculture"

c Daily Exposure (mg/day) = Application Rate (lb ai/Acre) * Treated Area (Acre/day) * Unit Exposure Value (mg or µg exposure/ lb ai handled) *[1mg/1000µg (conversion factor if necessary)].

d Absorbed Daily Dose (mg/kg/day) = Daily Exposure (mg/day) * Absorption Factor (0.20 for dermal; 1.0 for inhalation) ÷ Body Weight (60kg).

e Combined Absorbed Daily Dose (mg/kg/day) = Dermal Absorbed Daily Dose (mg/kg/day) + Inhalation Absorbed Daily Dose (mg/kg/day).

f MOE (unitless) = NOAEL (mg/kg/day) ÷ Combined Absorbed Daily Dose (mg/kg/day). Where NOAEL = 20 mg/kg/day for short-term and intermediate-term exposures. A Margin of Exposure (MOE) of 100 or greater is acceptable for Sodium Acifluorfen.

Table B4: Label Required PPE Acifluorfen Worker Exposure and Non-Cancer Risk

Exposure Scenario	Application Rates[a] (lb ai/Acre)	Treated Areas[b] (Acres/day)	Daily Exposure (mg/day)[c]		Absorbed Daily Dose (mg/kg/day)[d]		Combined Absorbed Daily Dose (mg/kg/day)[e]	Combined MOEs[f]
			Dermal	Inhalation	Dermal	Inhalation		
(1) Mix/Load Liquids for Aerial Application	0.158	350	1.3	0.066	0.0042	0.00111	0.0053	3741
(1) Mix/Load Liquids for Aerial Application	0.375	1200	10	0.54	0.0345	0.00900	0.0435	460
(2) Mix/Load Liquids for Groundboom Application	0.158	80	0.29	0.015	0.0010	0.00025	0.0012	16368
(2) Mix/Load Liquids for Groundboom Application	0.375	200	1.7	0.090	0.0058	0.00150	0.0073	2759
(3) Apply Spray with Fixed-Wing Aircraft	0.158	350	N/A	N/A	N/A	N/A	N/A	N/A
(3) Apply Spray with Fixed-Wing Aircraft	0.375	1200	N/A	N/A	N/A	N/A	N/A	N/A
(4) Apply Spray with Groundboom Sprayer	0.158	80	0.18	0.0094	0.0006	0.00016	0.0007	26818
(4) Apply Spray with Groundboom Sprayer	0.375	200	1.1	0.056	0.0035	0.00093	0.0044	4520
(5) Mix/Load/Apply - Groundboom	0.158	80	5.6	0.036	0.0185	0.0006	0.0191	1047
(5) Mix/Load/Apply - Groundboom	0.375	200	13.9	0.09	0.0463	0.0015	0.0478	419
(6) Flagging Aerial Applications	0.158	350	0.66	0.02	0.0022	0.00032	0.0025	7891
(6) Flagging Aerial Applications	0.375	1200	5.4	0.158	0.0180	0.00263	0.0206	970

Notes

a Application rates are minimum and maximum values found in Sodium Acifluorfen Use Closure Memo.

b Amounts of acreage treated per day are maximum values from the HED Science Advisory Council for Exposure Policy #009 " Standard Values for Daily Acres Treated in Agriculture"

c Daily Exposure (mg/day) = Application Rate (lb ai/Acre) * Treated Area (Acre/day) * Unit Exposure Value (mg or µg exposure/ lb ai handled) *[1mg/1000µg (conversion factor if necessary)].

d Absorbed Daily Dose (mg/kg/day) = Daily Exposure (mg/day) * Absorption Factor (0.20 for dermal; 1.0 for inhalation) ÷ Body Weight (60kg).

e Combined Absorbed Daily Dose (mg/kg/day) = Dermal Absorbed Daily Dose (mg/kg/day) + Inhalation Absorbed Daily Dose (mg/kg/day).

f MOE (unitless) = NOAEL (mg/kg/day) ÷ Combined Absorbed Daily Dose (mg/kg/day). Where NOAEL = 20 mg/kg/day for short-term and intermediate-term exposures.
A Margin of Exposure (MOE) of 100 or greater is acceptable for Sodium Acifluorfen.

Table B5: Single Layer PPE Acifluorfen Worker Exposure and Non-Cancer Risk

Exposure Scenario	Application Rates[a] (lb ai/Acre)	Treated Areas[b] (Acres/day)	Daily Exposure (mg/day)[c]		Absorbed Daily Dose (mg/kg/day)[d]		Combined Absorbed Daily Dose (mg/kg/day)[e]	Combined MOEs[f]
			Dermal	Inhalation	Dermal	Inhalation		
(1) Mix/Load Liquids for Aerial Application	0.158	350	1.3	0.013	0.0042	0.00022	0.0045	4483
(1) Mix/Load Liquids for Aerial Application	0.375	1200	10.4	0.108	0.0345	0.00180	0.0363	551
(2) Mix/Load Liquids for Groundboom Application	0.158	80	0.29	0.0030	0.0010	0.00005	0.0010	19615
(2) Mix/Load Liquids for Groundboom Application	0.375	200	1.7	0.018	0.0058	0.00030	0.0061	3306
(3) Apply Spray with Fixed-Wing Aircraft	0.158	350	N/A	N/A	N/A	N/A	N/A	N/A
(3) Apply Spray with Fixed-Wing Aircraft	0.375	1200	N/A	N/A	N/A	N/A	N/A	N/A
(4) Apply Spray with Groundboom Sprayer	0.158	80	0.18	0.0019	0.0006	0.00003	0.0006	32182
(4) Apply Spray with Groundboom Sprayer	0.375	200	1.1	0.011	0.0035	0.00019	0.0037	5424
(5) Mix/Load/Apply - Groundboom	0.158	80	5.6	0.0072	0.0185	0.0001	0.0186	1074
(5) Mix/Load/Apply - Groundboom	0.375	200	13.9	0.0180	0.0463	0.0003	0.0466	430
(6) Flagging Aerial Applications	0.158	350	0.66	0.0039	0.0022	0.00006	0.0023	8785
(6) Flagging Aerial Applications	0.375	1200	5.4	0.0315	0.0180	0.00053	0.0185	1080

Notes

a Application rates are minimum and maximum values found in Sodium Acifluorfen Use Closure Memo.

b Amounts of acreage treated per day are maximum values from the HED Science Advisory Council for Exposure Policy #009 " Standard Values for Daily Acres Treated in Agriculture"

c Daily Exposure (mg/day) = Application Rate (lb ai/Acre) * Treated Area (Acre/day) * Unit Exposure Value (mg or µg exposure/ lb ai handled) *[1mg/1000µg (conversion factor if necessary)].

d Absorbed Daily Dose (mg/kg/day) = Daily Exposure (mg/day) * Absorption Factor (0.20 for dermal; 1.0 for inhalation) ÷ Body Weight (60kg).

e Combined Absorbed Daily Dose (mg/kg/day) = Dermal Absorbed Daily Dose (mg/kg/day) + Inhalation Absorbed Daily Dose (mg/kg/day).

f MOE (unitless) = NOAEL (mg/kg/day) ÷ Combined Absorbed Daily Dose (mg/kg/day). Where NOAEL = 20 mg/kg/day for short-term and intermediate-term exposures.
A Margin of Exposure (MOE) of 100 or greater is acceptable for Sodium Acifluorfen.

Table B6: Baseline Clothing Worker Exposure and Cancer Risks for Sodium Acifluorfen

Exposure Scenario	Average Application Rate[a] (lb ai/Acre)	Average Treated Area[b] (A/day)	Annual Treatment Days[c]		Daily Exposure (mg/day)[d]		Potential Daily Dose (mg/kg/day)[e]		Combined Potential Daily Dose (mg/kg/day)[f]	Lifetime Average Daily Dose (mg/kg/day)[g]		Cancer Risk[h]	
			Private	Custom	Dermal	Inhalation	Dermal	Inhalation		Private	Custom	Private	Custom
(1) Mix/Load Liquids for Aerial Application	0.250	350	2	20	254	0.11	0.73	1.5e-03	0.73	2.0e-03	2.0e-02	2.5e-05	2.5e-04
(2) Mix/Load Liquids for Groundboom Application	0.250	80	2	20	58	0.024	0.17	3.4e-04	0.17	4.6e-04	4.6e-03	5.8e-06	5.8e-05
(3) Apply Spray with Fixed-Wing Aircraft	0250	350	N/A	20	0.44	0.0060	0.0013	8.5e-05	0.0013	N/A	3.7e-05	N/A	4.6e-07
(4) Apply Spray with Groundboom Sprayer	0.250	80	2	20	0.28	0.015	8.0e-04	2.1e-04	0.0010	2.8e-06	2.8e-05	3.5e-08	3.5e-07
(5) Mix/Load/Apply Liquids - Groundboom	0.250	80	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**N/A**	N/A	N/A	N/A
(6) Flagging Aerial Spray Applications	0.250	350	2	20	1.0	0.031	0.0028	4.4e-04	0.0032	8.7e-06	8.7e-05	1.1e-07	1.1e-06

Notes

a Typical or average application rates from the Sodium Acifluorfen Use Closure Memo.

b Amounts of acreage treated per day are average values from the HED Science Advisory Council for Exposure Policy #009 " Standard Values for Daily Acres Treated in Agriculture"

c Annual treatment days are assumed to be 2 days per year for private growers and 20 days per year for custom applicators.

d Daily Exposure (mg/day) = Application Rate (lb ai/Acre) * Treated Area (Acre/day) * Unit Exposure Value (mg or µg exposure/ lb ai handled) *[1mg/1000µg (conversion factor if necessary)].

e Potential Daily Dose (mg/kg/day) = Daily Exposure (mg/day) * Absorption Factor (0.20 for dermal; 1.0 for inhalation) ÷ Body Weight (60kg).

f Combined Potential Daily Dose (mg/kg/day) = Dermal Potential Daily Dose (mg/kg/day) + Inhalation Potential Daily Dose (mg/kg/day).

g Lifetime Averaged Daily Dose (mg/kg/day) = Combined Potential Daily Dose (mg/kg/day) * Annual Treatment Days / 365 days per year * 35 years working / 70 year lifespan.

h Carcinogenic Risk = Lifetime Averaged Daily Dose (mg/kg/day) * Q_1^* $(mg/kg/day)^{-1}$. Q_1^* = 0.0127 for sodium acifluorfen. Carcinogenic risks of 1.0 x 10^{-6} or lower are below the Agency's level of concern. Carcinogenic risks in the 1.0 x 10^{-6} to 1.0 x 10^{-4} range should be reduced, when feasible, via mitigation methods.

Table B7: LABEL REQUIRED PPE Worker Acifluorfen Exposure and Cancer Risks

Exposure Scenario	Typical Application Rate[a] (lb ai/A)	Average Treated Area[b] (Acre/day)	Annual Treatment Days[c]		Daily Exposure (mg/day)[d]		Potential Daily Dose (mg/kg/day)[e]		Combined Potential Daily Dose (mg/kg/day)[f]	Lifetime Average Daily Dose (mg/kg/day)[g]		Cancer Risk[h]	
			Private	Custom	Dermal	Inhalation	Dermal	Inhalation		Private	Custom	Private	Custom
(1) Mix/Load Liquids for Aerial Application	0.250	350	2	20	2.0	0.105	5.8e-03	1.5e-03	7.3e-03	2.0e-05	2.0e-04	2.5e-07	2.5e-06
(2) Mix/Load Liquids for Groundboom Application	0.250	80	2	20	0.46	0.024	1.3e-03	3.4e-04	1.7e-03	4.5e-06	4.5e-05	5.8e-08	5.8e-07
(3) Apply Spray with Fixed-Wing Aircraft	0.250	350	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
(4) Apply Spray with Groundboom Sprayer	0.250	80	2	20	0.28	0.015	8.0e-04	2.1e-04	1.0e-03	2.8e-06	2.8e-05	3.5e-08	3.5e-07
(5) Mix/Load/Apply - Groundboom	0.250	80	2	20	3.7	0.024	1.1e-02	3.4e-04	1.1e-02	3.0e-05	3.0e-04	3.8e-07	3.8e-06
(6) Flag Aerial Spray Applications	0.250	350	2	20	1.1	0.031	3.0e-03	4.4e-04	3.4e-03	9.4e-06	9.4e-05	1.2e-07	1.2e-06

Notes:

a Typical or average application rates from the Sodium Acifluorfen Use Closure Memo.

b Amounts of acreage treated per day are average values from the HED Science Advisory Council for Exposure Policy #009 " Standard Values for Daily Acres Treated in Agriculture"

c Annual treatment days are assumed to be 2 days per year for private growers and 20 days per year for custom applicators.

d Daily Exposure (mg/day) = Application Rate (lb ai/Acre) * Treated Area (Acres) * Unit Exposure Value (mg or µg exposure/ lb ai handled) *[1mg/1000µg (conversion factor if necessary)].

e Potential Daily Dose (mg/kg/day) = Daily Exposure (mg/day) * Absorption Factor (0.20 for dermal; 1.0 for inhalation) ÷ Body Weight (60kg).

f Combined Potential Daily Dose (mg/kg/day) = Dermal Potential Daily Dose (mg/kg/day) + Inhalation Potential Daily Dose (mg/kg/day).

g Lifetime Averaged Daily Dose (mg/kg/day) = Combined Potential Daily Dose (mg/kg/day) * Annual Treatment Days / 365 days per year * 35 years working / 70 year lifespan.

h. Carcinogenic Risk = Lifetime Averaged Daily Dose (mg/kg/day) * Q_1^* $(mg/kg/day)^{-1}$. Q_1^* = 0.0127 for sodium acifluorfen. Carcinogenic Risks of 1.0 X 10-6 or lower are below the Agency's level of concern. Carcinogenic risks in the 1.0×10^{-6} to 1.0×10^{-4} range should be reduced, when feasible, via mitigation methods.

Table B8: SINGLE LAYER PPE Worker Acifluorfen Exposure and Cancer Risks

Exposure Scenario	Typical Application Rate[a] (lb ai/A)	Average Treated Area[b] (Acre/day)	Annual Treatment Days[c]		Daily Exposure (mg/day)[d]		Potential Daily Dose (mg/kg/day)[e]		Combined Potential Daily Dose (mg/kg/day)[f]	Lifetime Average Daily Dose (mg/kg/day)[g]		Cancer Risk[h]	
			Private	Custom	Dermal	Inhalation	Dermal	Inhalation		Private	Custom	Private	Custom
(1) Mix/Load Liquids for Aerial Application	0.250	350	2	20	2.0	0.021	5.8e-03	3.0e-04	6.1e-03	1.7e-05	1.7e-04	2.1e-07	2.1e-06
(2) Mix/Load Liquids for Groundboom Application	0.250	80	2	20	0.46	0.0048	1.3e-03	6.9e-05	1.4e-03	3.8e-06	3.8e-05	4.8e-08	4.8e-07
(3) Apply Spray with Fixed-Wing Aircraft	0.250	350	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
(4) Apply Spray with Groundboom Sprayer	0.250	80	2	20	0.28	0.0030	8.0e-04	4.3e-05	8.4e-04	2.3e-06	2.3e-05	2.9e-08	2.9e-07
(5) Mix/Load/Apply - Groundboom	0.250	80	2	20	3.7	0.0048	1.1e-02	6.9e-05	1.1e-02	2.9e-05	2.9e-04	3.7e-07	3.7e-06
(6) Flag Aerial Spray Applications	0.250	350	2	20	1.1	0.0061	3.0e-03	8.8e-05	3.1e-03	8.5e-06	8.5e-05	1.1e-07	1.1e-06

Notes:

a Typical or average application rates from the Sodium Acifluorfen Use Closure Memo.

b Amounts of acreage treated per day are average values from the HED Science Advisory Council for Exposure Policy #009 " Standard Values for Daily Acres Treated in Agriculture"

c Annual treatment days are assumed to be 2 days per year for private growers and 20 days per year for custom applicators.

d Daily Exposure (mg/day) = Application Rate (lb ai/Acre) * Treated Area (Acres) * Unit Exposure Value (mg or µg exposure/ lb ai handled) *[1mg/1000µg (conversion factor if necessary)].

e Potential Daily Dose (mg/kg/day) = Daily Exposure (mg/day) * Absorption Factor (0.20 for dermal; 1.0 for inhalation) ÷ Body Weight (60kg).

f Combined Potential Daily Dose (mg/kg/day) = Dermal Potential Daily Dose (mg/kg/day) + Inhalation Potential Daily Dose (mg/kg/day).

g Lifetime Averaged Daily Dose (mg/kg/day) = Combined Potential Daily Dose (mg/kg/day) * Annual Treatment Days / 365 days per year * 35 years working / 70 year lifespan.

h Carcinogenic Risk = Lifetime Averaged Daily Dose (mg/kg/day) * Q_1^* $(mg/kg/day)^{-1}$. Q_1^* = 0.0127 for sodium acifluorfen. Carcinogenic Risks of 1.0 X 10-6 or lower are below the Agency's level of concern. Carcinogenic risks in the 1.0 x 10^{-6} to 1.0 x 10^{-4} range should be reduced, when feasible, via mitigation methods.

Table B9: Double Layer PPE Worker Acifluorfen Exposure and Cancer Risks

Exposure Scenario	Typical Application Rate[a] (lb ai/A)	Average Treated Area[b] (Acre/day)	Annual Treatment Days[c]		Daily Exposure (mg/day)[d]		Potential Daily Dose (mg/kg/day)[e]		Combined Potential Daily Dose (mg/kg/day)[f]	Lifetime Average Daily Dose (mg/kg/day)[g]		Cancer Risk[h]	
			Private	Custom	Dermal	Inhalation	Dermal	Inhalation		Private	Custom	Private	Custom
(1) Mix/Load Liquids for Aerial Application	0.250	350	2	20	1.5	0.011	4.3e-03	1.5e-04	4.4e-03	1.2e-05	1.2e-04	1.5e-07	1.5e-06
(2) Mix/Load Liquids for Groundboom Application	0.250	80	2	20	0.34	0.0024	9.7e-04	3.4e-05	1.0e-03	2.8e-06	2.8e-05	3.5e-08	3.5e-07
(3) Apply Spray with Fixed-Wing Aircraft	0.250	350	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
(4) Apply Spray with Groundboom Sprayer	0.250	80	2	20	0.22	0.0026	6.3e-04	3.7e-05	6.7e-04	1.8e-06	1.8e-05	2.3e-08	2.3e-07
(5) Mix/Load/Apply -Groundboom	0.250	80	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
(6) Flag Aerial Spray Applications	0.250	350	2	20	1.0	0.0031	2.8e-03	4.4e-05	2.8e-03	7.7e-06	7.7e-05	9.7e-08	9.7e-07

Notes:

a Typical or average application rates from the Sodium Acifluorfen Use Closure Memo.

b Amounts of acreage treated per day are average values from the HED Science Advisory Council for Exposure Policy #009 " Standard Values for Daily Acres Treated in Agriculture"

c Annual treatment days are assumed to be 2 days per year for private growers and 20 days per year for custom applicators.

d Daily Exposure (mg/day) = Application Rate (lb ai/Acre) * Treated Area (Acres) * Unit Exposure Value (mg or µg exposure/ lb ai handled) *[1mg/1000µg (conversion factor if necessary)].

e Potential Daily Dose (mg/kg/day) = Daily Exposure (mg/day) * Absorption Factor (0.20 for dermal; 1.0 for inhalation) ÷ Body Weight (60kg).

f Combined Potential Daily Dose (mg/kg/day) = Dermal Potential Daily Dose (mg/kg/day) + Inhalation Potential Daily Dose (mg/kg/day).

g Lifetime Averaged Daily Dose (mg/kg/day) = Combined Potential Daily Dose (mg/kg/day) * Annual Treatment Days / 365 days per year * 35 years working / 70 year lifespan.

h Carcinogenic Risk = Lifetime Averaged Daily Dose (mg/kg/day) * Q_1^* $(mg/kg/day)^{-1}$. Q_1^* = 0.0127 for sodium acifluorfen. Carcinogenic Risks of 1.0 X 10-6 or lower are below the Agency's level of concern. Carcinogenic risks in the 1.0 x 10^{-6} to 1.0 x 10^{-4} range should be reduced, when feasible, via mitigation methods.

Table B10: Engineering Controls Worker Acifluorfen Exposure and Cancer Risks

Exposure Scenario	Typical Application Rate[a] (lb ai/A)	Average Treated Area[b] (Acre/day)	Annual Treatment Days[c]		Daily Exposure (mg/day)[d]		Potential Daily Dose (mg/kg/day)[e]		Combined Potential Daily Dose (mg/kg/day)[f]	Lifetime Average Daily Dose (mg/kg/day)[g]		Cancer Risk[h]	
			Private	Custom	Dermal	Inhalation	Dermal	Inhalation		Private	Custom	Private	Custom
(1) Mix/Load Liquids for Aerial Application	0.250	350	2	20	0.75	0.0073	2.2e-03	1.0e-04	2.3e-03	6.2e-06	6.2e-05	7.8e-08	7.8e-07
(2) Mix/Load Liquids for Groundboom Application	0.250	80	2	20	0.17	0.0017	4.9e-04	2.4e-05	5.2e-04	1.4e-06	1.4e-05	1.8e-08	1.8e-07
(3) Apply Spray with Fixed-Wing Aircraft	0.250	350	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
(4) Apply Spray with Groundboom Sprayer	0.250	80	2	20	0.10	0.0009	2.9e-04	1.2e-05	3.0e-04	8.2e-07	8.2e-06	1.0e-08	1.0e-07
(5) Mix/Load/Apply -Groundboom	0.250	80	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
(6) Flag Aerial Spray Applications	0.250	350	2	20	0.019	0.0006	5.5e-05	8.8e-06	6.4e-05	1.7e-07	1.7e-06	2.2e-09	2.2e-08

Notes:

a Typical or average application rates from the Sodium Acifluorfen Use Closure Memo.

b Amounts of acreage treated per day are average values from the HED Science Advisory Council for Exposure Policy #009 " Standard Values for Daily Acres Treated in Agriculture"

c Annual treatment days are assumed to be 2 days per year for private growers and 20 days per years for custom applicators.

d Daily Exposure (mg/day) = Application Rate (lb ai/Acre) * Treated Area (Acres) * Unit Exposure Value (mg or µg exposure/ lb ai handled) *[1mg/1000µg (conversion factor if necessary)].

e Potential Daily Dose (mg/kg/day) = Daily Exposure (mg/day) * Absorption Factor (0.20 for dermal; 1.0 for inhalation) ÷ Body Weight (60kg).

f Combined Potential Daily Dose (mg/kg/day) = Dermal Potential Daily Dose (mg/kg/day) + Inhalation Potential Daily Dose (mg/kg/day).

g Lifetime Averaged Daily Dose (mg/kg/day) = Combined Potential Daily Dose (mg/kg/day) * Annual Treatment Days / 365 days per year * 35 years working / 70 year lifespan.

h Carcinogenic Risk = Lifetime Averaged Daily Dose (mg/kg/day) * Q_1^* $(mg/kg/day)^{-1}$. Q_1^* = 0.0127 for sodium acifluorfen. Carcinogenic Risks of 1.0 X 10-6 or lower are below the Agency's level of concern. Carcinogenic risks in the 1.0 x 10^{-6} to 1.0 x 10^{-4} range should be reduced, when feasible, via mitigation methods.

Table B11: Summary of Acifluorfen Occupational Exposure Scenarios and Non-Cancer Risks

Exposure Scenario	Application Rate[a]	Treated Area[b]	Baseline PPE[c] MOE[e]	Label Required[d] PPE MOE	SINGLE LAYER PPE[e] MOE[f]
(1) Mix/Load Liquids for Aerial Application	0.158	350	**37**	3700	4500
	0.375	1200	**4.6**	460	550
(2) Mix/Load Liquids for Groundboom Application	0.158	80	160	16000	20000
	0.375	200	**28**	2800	3300
(3) Applying Spray with Fixed-Wing Aircraft	0.158	350	20000	20000	N/A
	0.375	1200	2500	2500	N/A
(4) Apply Spray with a Groundboom Sprayer	0.158	80	27000	27000	32000
	0.375	200	4500	4500	3700
(5) Mix/Load/Apply Liquids - Groundboom	0.158	80	N/A	1000	1100
	0.375	200	N/A	420	430
(6) Flagging Aerial Spray Applications	0.158	350	8500	7900	8800
	0.375	1200	1000	970	1100

Notes:

a Application rates are minimum and maximum values found in Sodium Acifluorfen Use Closure Memo.

b Amounts of acreage treated per day are maximum values from the HED Science Advisory Council for Exposure Policy #009 " Standard Values for Daily Acres Treated in Agriculture"

c Baseline PPE includes long pants, long sleeved shirt, no gloves, no respirator.

d. Label Required PPE includes long pants, long sleeved shirt and chemical resistant gloves

e. Single Layer PPE includes chemical resistant gloves, long pants, long sleeved shirt, hat and dust/mist respirator.

f. MOE (unitless) = NOAEL (mg/kg/day) ÷ Combined Absorbed Daily Dose (mg/kg/day). Where NOAEL = 20 mg/kg/day for short-term and intermediate-term exposures. A Margin of Exposure (MOE) of 100 or greater is acceptable for Sodium Acifluorfen.

Table B12: Summary of Acifluorfen Occupational Cancer Risks for Private Growers

Exposure Scenario	Application Rate[a] (lb ai/Acre)	Treated Area[b] (Acres/day)	Baseline PPE Cancer Risk[d]	Label Required PPE	Single Layer PPE Cancer Risk[d]	Double Layer PPE Cancer Risk[d]	Engineering Controls Cancer Risk[d]
(1) Mix/Load Liquids for Aerial Application	0.250	350	2.5e-05	2.5e-07	2.1e-07	1.5e-07	7.8e-08
(2) Mix/Load Liquids for Groundboom Application	0.250	80	5.8e-06	5.8e-08	4.8e-08	3.5e-08	1.8e-08
(3) Apply Spray with Fixed-Wing Aircraft	0.250	350	N/A	N/A	N/A	N/A	N/A
(4) Apply Spray with Groundboom Sprayer	0.250	80	3.5e-08	3.5e-08	2.9.e-08	2.3e-08	1.0e-08
(5) Mix/Load/Apply - Groundboom	0.250	80	N/A	3.8e-07	3.7e-07	N/A	N/A
(6) Flagging Aerial Spray Applications	0.250	350	1.1e-07	1.2e-07	1.1e-07	9.7e-08	2.2e-09

Table B13: Summary of Acifluorfen Occupational Cancer Risks for Custom Applicators

Exposure Scenario	Application Rate[a] (lb ai/Acre)	Treated Area[b] (Acres/day)	Baseline PPE Cancer Risk[d]	Label Required PPE[d]	Single Layer PPE Cancer Risk[d]	Double Layer PPE Cancer Risk[d]	Engineering Controls Cancer Risk[d]
(1) Mix/Load Liquids for Aerial Application	0.250	350	**2.5e-04**	2.5e-06	2.1e-06	1.5e-06	7.8e-07
(2) Mix/Load Liquids for Groundboom Application	0.250	80	5.8e-05	5.8e-07	4.8e-07	3.5e-07	1.8e-07
(3) Apply Spray with Fixed-Wing Aircraft	0.250	350	4.6e-07	N/A	N/A	N/A	N/A
(4) Apply Spray with Groundboom Sprayer	0.250	80	3.5e-07	3.5e-07	2.9e-07	2.3e-07	1.0e-07
(5) Mix/Load/Apply - Groundboom	0.250	80	N/A	3.8e-06	3.7e-06	N/A	N/A
(6) Flagging Aerial Spray Applications	0.250	350	1.1e-06	1.2e-06	1.1e-06	9.7e-07	2.2e-08

Notes:

a Application rates are average or typical values found in Sodium Acifluorfen Use Closure Memo.

b Amounts of acreage treated per day are average values from the HED Science Advisory Council for Exposure Policy #009 " Standard Values for Daily Acres Treated in Agriculture"

c Annual treatment days are assumed to be 2 days per year for private growers and 20 days per year for custom applicators.

d Carcinogenic Risk = Lifetime Averaged Daily Dose (mg/kg/day) * Q_1^* $(mg/kg/day)^{-1}$. Q_1^* = 0.0127 for sodium acifluorfen. Carcinogenic risks of 1.0×10^{-6} or lower are below the Agency's level of concern. Carcinogenic risks in the 1.0×10^{-6} to 1.0×10^{-4} range should be reduced when feasiible.

APPENDIX C

SODIUM ACIFLUORFEN POST-APPLICATION OCCUPATIONAL EXPOSURE AND RISK ASSESSMENT TABLES

Table C1: Summary of Occupational Post-Application Risks for Sodium Acifluorfen (Irrigating and Scouting Peanuts, Rice and Soybeans)

Application Rate (Lbs Ai/acre)	Exposed Person	Day 0 DFR ($\mu g/cm^2$)	Transfer Coefficient (cm^2/hour)	Non-Cancer Dose on Day 0 (mg/kg/day)[3]	Non-Cancer MOE[2]	Cancer Dose on Day 0 (mg/kg/day)[3]	Annual # Days Irrigation and Scouting	Cancer Risk on Day 0[4,5,6]	Day on which Cancer Risk is less than 1 x 10^{-6}
Using Indiana DFR Data from MRID 440911-01.									
0.250	Private Grower Professional	0.451	1500	N/A	N/A	0.0155	2 20	5.4E-07 5.4E-06	0 4
0.375	Private Grower Professional	0.68	1500	0.023	740	N/A	N/A	N/A	N/A
Using Mississippi DFR data from MRID 440911-01.									
0.250	Private Grower Professional	0.49	1500	N/A	N/A	0.0169	2 20	5.9E-07 5.9E-06	0 2
0.375	Private Grower Professional	0.74	1500	0.025	680	N/A	N/A	N/A	N/A

NOTES: Values rounded; calculations are based on spreadsheet analyses. It is assumed that workers are wearing long pants, long sleeved shirts and no gloves.

1. Non-Cancer Dose (mg/kg/day) = [Measured DFR ($\mu g/cm^2$) * Transfer Coefficient (1,500 cm^2/hr) * dermal absorption factor (0.20) * (8 hr/work day) * (1mg/1000 µg conversion factor)] ÷60 kg Body Weight.

2. Same as above except 70 kg is used for body weight.

3. MOE for Dermal Short and Intermediate-Term Exposure = $NOAEL_{dermal}$/ Dose; where $NOAEL_{dermal}$ = 20 mg/kg/day for Sodium Acifluorfen. MOEs of 100 or above are acceptable for Acifluorfen.

4. Lifetime Averaged Daily Dose (mg/kg/day) = Cancer Dose (mg/kg/day) * (# Days per year scouting and irrigating / 365 days per year) * (35 years working /70 year lifespan)

5. Carcinogenic Risk = Lifetime Averaged Daily Dose (mg/kg/day) * Q_1^* $(mg/kg/day)^{-1}$. Q_1^* = 0.0127 for sodium acifluorfen.

6. Carcinogenic risks of 1.0 x 10^{-6} or lower are below the Agency's level of concern. Carcinogenic risks in the 1.0 x 10^{-6} to 1.0 x 10^{-4} range should be reduced, when feasible, via mitigation methods.

Spreadsheet C2 - Acifluorfen Cancer Risks Based Upon Indiana DFR Data

Chemical:	Acifluorfen
Reason:	Cancer Risk Using Indiana DFR Data
Date:	11/05/01
Transfer Coefficient Group:	Field/row crop, low/medium
Specific Crop(s) Considered:	Soybeans, Rice, Peanuts
Application Rate of Crop (lb ai/A):	0.25

DFR Data Summary

Data Source (enter 1 if data available, 0 ifdefaults):	1
Source:	Indiana DFR Data
Slope of Semilog Regression:	-0.493
[Initial] (ug/cm2):	0.677
Study Application Rate (lb ai/A):	0.375
Limit of Quantification(ug/cm2):	0.012

Toxicology & Exposure Factor Inputs:

Q Star	0.014
Years of Exposure Per Life Time	35
Days of Exposure per year for Private Growers	2
Days of Exposure per year for Commercial Workers	20
Adult Exposure Duration (hrs/day):	8
Adult Body Weight (kg):	70
Dermal Abs. (%):	20

Exposure Inputs Summary

Exposure Potential	Transfer Coefficients (cm2/hour)		Activities
	Used For RA	Range	
Very Low	N/A	N/A	N/A
Medium	1500	486 to 2760	Irrigation, scouting, weeding mature/high foliage plants

DAT	DFR LEVELS (ug/cm2)		Dose (mg/kg/day)		Cancer Risk	
	Not Adjusted	Adjusted For Rate	Low Exposure	Medium Exposure	Private Grower	Commercial Worker
0	0.677	0.451	N/A	0.0155	5.4E-007	5.4E-006
1	0.414	0.276	N/A	0.0095	3.3E-007	3.3E-006
2	0.253	0.168	N/A	0.0058	2.0E-007	2.0E-006
3	0.154	0.103	N/A	0.0035	1.2E-007	1.2E-006
4	0.094	0.063	N/A	0.0022	7.5E-008	7.5E-007

Spreadsheet C3 - Acifluorfen Cancer Risks Based Upon Mississippi DFR Data

Chemical:	Acifluorfen
Reason:	Cancer Risk Using Mississippi DFR Data
Date:	11/05/01
Transfer Coefficient Group:	Field/row crop, low/medium
Specific Crop(s) Considered:	Soybeans, Rice, Peanuts
Application Rate of Crop (lb ai/A):	0.25

DFR Data Summary

Data Source	Mississippi DFR Data
Slope of Semilog Regression:	-1.55
[Initial] (ug/cm2):	0.74
Study Application Rate (lb ai/A):	0.375
Limit of Quantification (ug/cm2):	0.012

Toxicology & Exposure Factor Inputs:

Q Star	0.014
Years of Exposure Per Life Time	35
Days of Exposure per year for Private Growers	2
Days of Exposure per year for Commercial Workers	20
Adult Exposure Duration (hrs/day):	8
Adult Body Weight (kg):	70
Dermal Abs. (%):	20

Exposure Inputs Summary

Exposure Potential	Transfer Coefficients (cm2/hour)		Activities
	Used For RA	Range	
Very Low	N/A	N/A	N/A
Medium	1500	486 to 2760	Irrigation, scouting, weeding mature/high foliage plants

DAT	DFR LEVELS (ug/cm2)		Dose (mg/kg/day)		Cancer Risk	
	Not Adjusted	Adjusted For Rate	Low Exposure	Medium Exposure	Private Grower	Commercial Worker
0	0.740	0.493	N/A	0.0169	5.9E-007	5.9E-006
1	0.157	0.105	N/A	0.0036	1.2E-007	1.2E-006
2	0.033	0.022	N/A	0.0008	2.7E-008	2.7E-007

Spreadsheet C4 - Acifluorfen Non-Cancer Risks Based Upon Indiana DFR Data

Chemical:	Acifluorfen
Reason:	Non-Cancer Risk Using Indiana DFR Data
Date:	11/05/01
Transfer Coefficient Group:	Field/row crop, low/medium
Specific Crop(s) Considered:	Soybeans, Rice, Peanuts
Application Rate of Crop (lb ai/A):	0.375

DFR Data Summary

Data Source:	Indiana DFR Data
Slope of Semilog Regression:	-0.493
[Initial] (ug/cm2):	0.677
Study Application Rate (lb ai/A):	0.375
Limit of Quantification (ug/cm2):	0.012

Toxicology & Exposure Factor Inputs:

Short/Intermediate Term Dermal	20
NOAEL (mg/kg/day)	8
Adult Exposure Duration (hrs/day):	60
Adult Body Weight (kg):	20
Dermal Abs. (%):	

Exposure Inputs Summary

Exposure Potential	Transfer Coefficients (cm2/hour)		Activities
	Used For RA	Range	
Very Low	N/A	N/A	N/A
Medium	1500	486 to 2760	Irrigation, scouting, weeding mature/high foliage plants

DAT	DFR LEVELS (ug/cm2)		Dose (mg/kg/day)		MOE
	Not Adjusted	Adjusted For Rate	Low Exposure	Medium Exposure	
0	0.677	0.677	N/A	0.0271	739

Spreadsheet C5 - Acifluorfen Non-Cancer Risks Based Upon Mississippi DFR Data

Chemical:	Acifluorfen
Reason:	Non-Cancer Risk Using Mississippi DFR Data
Date:	11/05/01
Transfer Coefficient Group:	Field/rowcrop,low/medium
Specific Crop(s) Considered:	Soybeans, Rice, Peanuts
Application Rate of Crop (lb ai/A):	0.375

DFR Data Summary

Data Source:	Mississippi DFR Data
Slope of Semilog Regression:	-1.55
[Initial] (ug/cm2):	0.74
Study Application Rate (lb ai/A):	0.375
Limit of Quantification (ug/cm2):	0.012

Toxicology & Exposure Factor Inputs:

Short/Intermediate Term Dermal NOAEL (mg/kg/day)	
Adult Exposure Duration (hrs/day):	
Adult Body Weight (kg):	
Dermal Abs. (%):	

Exposure Inputs Summary

Exposure Potential	Transfer Coefficients (cm2/hour)		Activities
	Used For RA	Range	
Very Low	N/A	N/A	N/A
Medium	1500	486 to 2760	Irrigation, scouting, weeding mature/high foliage plants

DAT	DFR LEVELS (ug/cm2)		Dose (mg/kg/day)		MOE
	Not Adjusted	Adjusted For Rate	Low Exposure	Medium Exposure	
0	0.740	0.740	N/A	0.0296	676

APPENDIX D

SODIUM ACIFLUORFEN
RESIDENTIAL HANDLER
EXPOSURE AND RISK
ASSESSMENT TABLES

Table D1: Numerical Inputs for Residential Handler Exposure to Sodium Acifluorfen.

Exposure Scenario	Amount of Sodium Acifluorfen Per Quart Container[a]	Application rate[b]	Unit Exposure Values	
			Dermal[c] (mg/lb ai handled)	Inhalation[d] (µg/lb ai handled)
(1) Spot Treat Weeds Using RTU Trigger Sprayer	0.12% Ai or 0.0030 lb Ai/Quart	2 quarts /day = 0.006 lb Ai/day	53	0.067

a. Container sizes as listed on the labels range from 24 ounces to one gallon. All of the formulations contain 0.12% sodium acifluorfen.
b. This application rate was assumed for spot treatment based on HED knowledge of similar scenarios.
c. Baseline dermal unit exposure represents an individual's estimated exposure while wearing short pants, short sleeved shirt, no gloves.
d. Baseline inhalation unit exposure represents no use of a respirator.

Table D2: Exposure and Non-Cancer Risks for Residential Handlers of Sodium Acifluorfen.

Exposure Scenario	Daily Exposure (mg/day)[a]		Absorbed Daily Dose (mg/kg/day)[b]		Combined Absorbed Daily Dose (mg/kg/day)[c]	Combined MOE[d,e]
	Dermal	Inhalation	Dermal	Inhalation		
(1) Spot Treat Weeds	0.32	0.00040	0.0011	6.7×10^{-6}	0.0011	18000

a. Daily Exposure = Amount of Ai Used * Unit Exposure Value * Conversion Factor (if necessary)
(mg/day) (lb/day) (mg or *u*g/lb ai handled) (1 mg/1000 ug)

b. Absorbed Daily Dose = Daily Exposure * Absorption Factor (0.2 for dermal, 1.0 for inhalation) / Body Weight (60 kg)
(mg/kg/day) (mg/day)

c. Combined Absorbed Daily Dose (CADD) = Dermal Absorbed Daily Dose + Inhalation Absorbed Daily Dose
(mg/kg/day) (mg/kg/day) (mg/kg/day)

d. MOE = NOAEL (mg/kg/day)/CADD (mg/kg/day). Where NOAEL = 20 mg/kg/day for short term and and intermediate term exposure.

e. A Margin of Exposure (MOE) of 1000 or greater is acceptable for Acifluorfen.

Table D3: Exposure and Cancer Risks for Residential Handlers of Sodium Acifluorfen.

Exposure Scenario	Daily Exposure (mg/day)[a]		Absorbed Daily Dose (mg/kg/day)[b]		Combined Absorbed Daily Dose (mg/kg/day)[c]	Annual Treatment Days	LADD (mg/kg/day)[d]	Cancer Risk[e,f]
	Dermal	Inhalation	Dermal	Inhalation				
(1) Spot Treat Weeds	0.32	0.00040	0.00091	5.7×10^{-6}	0.00092	2	3.6×10^{-6}	4.5×10^{-8}

a. Same as in Table 2 above.

b. Same as in Table 2 except that a body weight of 70 kg was used instead of 60 kg.

c. Combined Absorbed Daily Dose (CADD) = Dermal Absorbed Daily Dose + Inhalation Absorbed Daily Dose
(mg/kg/day) (mg/kg/day) (mg/kg/day)

d. Lifetime Averaged Daily Dose (LADD) = CADD * (Annual Treatment Days/365 days per year)*(50 years exposure/70 year lifespan)
(mg/kg/day)

e. Cancer Risk = LADD (mg/kg/day)*Q_1* (mg/kg/day)$^{-1}$. Q_1* = 0.0127 for Acifluorfen.

f. Cancer risks less than 1.0×10^{-6} are below HED's level of concern.

Table D4: Residential Exposure Scenario Description for the Use of Sodium Acifluorfen.

Exposure Scenario (Number)	Data Source[a]	Data Confidence[b]
(1) Spot Treat Weeds Using RTU Trigger Sprayer	MRID 444598-01	Dermal Replicates = 20, A grade Hand replicates =20, A grade Inhalation replicates = 20, A grade High confidence in all data

a. This study involved low pressure handwand and RTU trigger sprayer application of Sevin(r) which contains 21% carbaryl to home vegetable plants. Applications were made by volunteers to two 18 foot rows of tomatoes and one 18 four foot row of cucumbers at a test field in Florida. A total of 40 replicates were conducted. Latex gloves were worn for twenty of the replicates and no gloves were worn for the other twenty replicates. Each replicate opened the end use product and applied it to the vegetable rows, after which the dosimeters were collected. Inhalation exposure was monitored in the breathing zone with personal air sampling pumps and OVS sampling tubes. Dermal exposure was monitered by the extraction of carbaryl from inner and outer cotton full body dosimeters, face neck wipes, and glove and hand washes. Dermal exposure was determined by adding the values from the bare hand rinses, face/neck wipes, outer dosimeter lower legs and arms, inner dosimeter torso and inner dosimeter upper legs and upper arms. This accounts for the residential applicator wearing a short sleeved shirt and short pants. Per Agency policy, the geometric mean values, as shown in Table D5, are used for exposure assessment while the other values are shown for comparison.

Table D5 - Unit Exposure Values For Trigger and Pump Sprayer Application (MRID 444598-01)

Scenario	Dermal Unit Exposure (mg/lb ai handled)			Inhalation Unit Exposure (ug/lb ai handled)		
	Average	Geo. Mean	Median	Average	Geo. Mean	Median
Trigger Sprayer	80	53	53	0.096	0.067	0.034
Hand Held Pump Sprayer	56	38	35	0.012	0.030	0.011

b. The study was graded using data confidence criteria as listed in the PHED Surrogate Exposure Guide, Version 1.1. The average field fortification recoveries for the full body dosimeters were 84.3% for the inner and 77.7 % for the outer. Face/neck wipe field recoveries were 84.8% and handwash and OVS tube field recoveries were greater than 90 %. Laboratory method validation for each sampling matrix fell within the acceptable range of 70 % to 120%. The limit of quantitation (LOQ) was 1.0 ug/sample for all media except the OVS tubes where the LOQ was 0.01 ug/sample.

APPENDIX E

ACIFLUORFEN INCIDENT REPORTS

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
PREVENTION, PESTICIDES
AND
TOXIC SUBSTANCES

April 6, 2000

MEMORANDUM

SUBJECT: Review of Acifluorfen Sodium Incident Reports
DP Barcode D264815, Chemical #114401

FROM: Jerome Blondell, Ph.D., Health Statistician
Chemistry and Exposure Branch 1
Health Effects Division (7509C)

Monica F. Spann, M.P.H., Environmental Health Scientist
Chemistry and Exposure Branch 1
Health Effects Division (7509C)

THRU: Francis B. Suhre, Senior Scientist
Chemistry and Exposure Branch 1
Health Effects Division (7509C)

TO: Kit Farwell, Veterinary Medical Officer
Reregistration Branch I
Health Effects Division (7509C)

BACKGROUND

The following data bases have been consulted for the poisoning incident data on the active ingredient Acifluorfen Sodium (PC Code:114401):

1) OPP Incident Data System (IDS) - reports of incidents from various sources, including registrants, other federal and state health and environmental agencies and individual consumers, submitted to OPP since 1992. Reports submitted to the Incident Data System represent anecdotal reports or allegations only, unless otherwise stated. Typically no conclusions can be drawn implicating the pesticide as a cause of any of the reported health effects. Nevertheless, sometimes with enough cases and/or enough documentation risk mitigation measures may be suggested.

2) Poison Control Centers - as the result of a data purchase by EPA, OPP received Poison Control Center data covering the years 1993 through 1996 for all pesticides. Most of the national Poison Control Centers (PCCs) participate in a national data collection system, the Toxic Exposure Surveillance System which obtains data from about 65-70 centers at hospitals and universities. PCCs provide telephone consultation for individuals and health care providers on suspected poisonings, involving drugs, household products, pesticides, etc.

3) California Department of Pesticide Regulation - California has collected uniform data on suspected pesticide poisonings since 1982. Physicians are required, by statute, to report to their local health officer all occurrences of illness suspected of being related to exposure to pesticides. The majority of the incidents involve workers. Information on exposure (worker activity), type of illness (systemic, eye, skin, eye/skin and respiratory), likelihood of a causal relationship, and number of days off work and in the hospital are provided.

4) National Pesticide Telecommunications Network (NPTN) - NPTN is a toll-free information service supported by OPP. A ranking of the top 200 active ingredients for which telephone calls were received during calendar years 1984-1991, inclusive has been prepared. The total number of calls was tabulated for the categories human incidents, animal incidents, calls for information, and others.

ACIFLUORFEN SODIUM REVIEW

I. Incident Data System

There were no reported cases of incidents related to acifluorfen sodium in the Incident Data System where it alone was responsible for an incident.

II. Poison Control Center Data - 1993 through 1996 - No Data

III. California Data - 1982 through 1996 - No Data

IV. National Pesticide Telecommunications Network

On the list of the top 200 chemicals for which NPTN received calls from 1984-1991 inclusively, acifluorfen sodium was not reported to be involved in human incidents.

VI. Conclusions

No information is available on incidents related to the use of acifluorfen sodium from any of the available data sources consulted by the Health Effects Division. Little or no usage has been reported for this pesticide, either in surveys of home use or agricultural use in California.

VII. Recommendations

No recommendations can be made given the absence of use and incident information for acifluorfen sodium.

cc: Correspondence Acifluorfen Sodium file (chemical no. 114401)